2.0 Subwatershed Descriptions

The Pahsimeroi River subbasin is divided into six 4th-field subwatersheds (Figure 6). The Pahsimeroi River itself is divided among four of these subwatersheds, and Patterson Creek and Big Creek are each an additional subwatershed. This method of lumping watersheds may be different from watershed groupings used by other agencies. Caution should be used in extrapolating area-based information between different grouping methods. For example, the Pahsimeroi subbasin review produced by the BLM and the Forest Service (FS) (BLM/FS, 1999) uses an entirely different grouping methodology for subwatersheds.

2.1 Pahsimeroi River

The Pahsimeroi River subwatershed includes the lower end of the Pahsimeroi River from Trail Creek to the confluence with the Salmon River. Tributaries include the Morgan Creek/Tater Creek complex on the east side and Trail Creek, the Lawson Creek complex, Anderson Spring, and John Short Spring on the west side. Morgan Creek is further divided into the North Fork and the East Fork on the Salmon-Challis National Forest in the Lemhi Range. The Lawson Creek drainage includes the North Fork, Middle Fork and South Fork of Lawson Creek, all originating in the Pahsimeroi Mountains of the Lost River Range on the Salmon-Challis National Forest.

The streams on the west side of the subwatershed (e.g., Lawson Creek) are relatively small and usually contribute flow to the valley bottom only during periods of the highest flow (spring runoff) (Meinzer, 1924). The Morgan Creek drainage on the east side is larger. It covers about 20 to 30 square miles and has more flow than west side drainages (Meinzer, 1924). Morgan Creek, according to Meinzer (1924), after leaving the canyon area passes over an area of coarse gravel and boulders that is very porous. Estimated mean monthly flows for Little Morgan Creek range from 6 cfs (October) to 171 cfs (June) (BLM, 1999a). In Lawson Creek, mean monthly flows vary from 1 to 5 cfs (BLM, 1999a). It is important to note that monthly mean flow estimates for these and other streams in the subbasin do not segregate the amount of flow that results in subsurface drainage. In other words, an estimated mean monthly flow of 6 cfs in the fall may occur entirely underground with no visible surface flow in lower reaches.

Little Morgan Creek and Tater Creek have bull trout, and the lower Pahsimeroi River contained Chinook, steelhead, and bull trout among other species (BLM, 1999a). Little Morgan Creek also contained westslope cutthroat trout. According to the same source, Lawson Creek contained rainbow trout.

2.2 Falls Creek

The Falls Creek subwatershed is actually a large swath of land across the Pahsimeroi Valley from Falls Creek and Morse Creek on the east side to Sulphur Creek, Meadow Creek, and Grouse Creek on the west side. The subwatershed includes that portion of the Pahsimeroi River from Big Creek to Sulphur Creek.

Falls Creek and Morse Creek, like Morgan Creek, have drainages 20 to 30 square miles in size and produce a fair amount of water for streams in this subbasin (Meinzer, 1924). In 1924, Falls Creek only contributed water to the Pahsimeroi River during the peak of the runoff period, and lost considerable amounts of water to subsurface drainage (Meinzer, 1924). Also, all low flow water

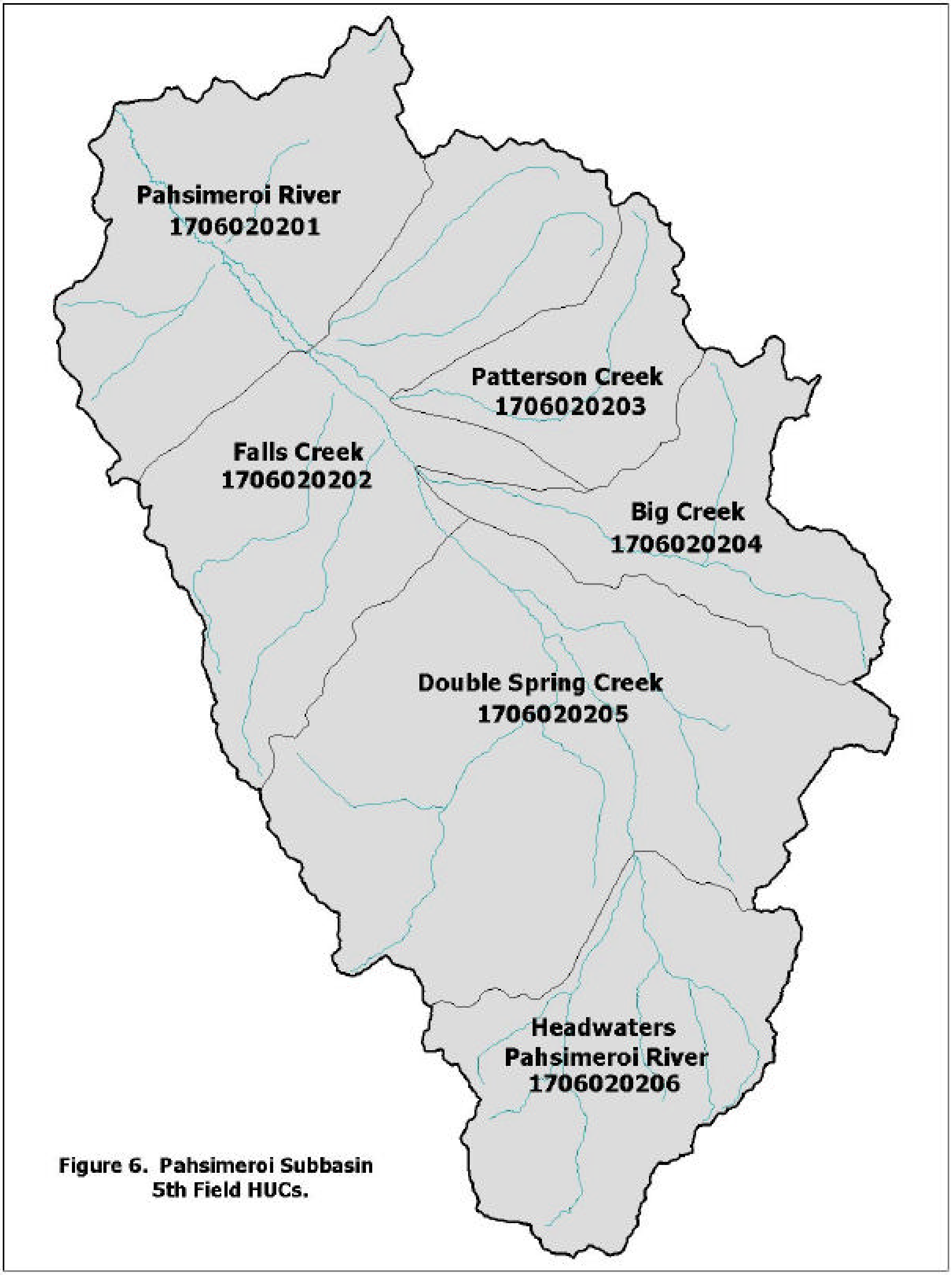

Figure 6. Pahsimeroi Subbasin 5th Field HUCs.

and much of the remaining high flow water was diverted for water rights at that time. In 1924, Morse Creek had a channel width of several hundred feet at the canyon mouth (Meinzer, 1924). Due to losses to the subsurface, Morse Creek would now need twice as much flow to deliver the amount of water required for the last water right diversion. The estimated mean monthly flows for Falls Creek vary from 8 cfs (October) to 136 cfs (June) (BLM, 1999a). Likewise, Morse Creek flows vary from 7 cfs (October) to 123 cfs (June).

Grouse Creek is probably the largest of the west side streams, although all of these streams contribute very little surface water to the valley bottom (Meinzer, 1924). The estimated mean monthly flows for Grouse Creek vary from 0 cfs (November) to 5.5 cfs (June) (BLM, 1999a). Meadow Creek and Sulphur Creek have mean monthly flows ranging from 0.4 cfs (November) to 4.1 cfs (May) and 0.5 cfs (August) to 2.9 cfs (May), respectively (BLM, 1999a).

Morse Creek and Falls Creek both contained bull trout and westslope cutthroat during the early 1990s (BLM, 1999a). Sulphur Creek contained rainbow trout in 1991 but not in 1994 (BLM, 1999a).

2.3 Patterson Creek

The Patterson Creek subwatershed includes only the Patterson Creek drainage from its origination in the Lemhi Mountains to the Pahsimeroi valley floor. Tributaries include the East Fork and Inyo Creek. Patterson Creek has a drainage area from 20 to 30 square miles in size, and was considered one of the more efficient water delivery streams in the valley, from a water rights perspective, because of early diversions (Meinzer, 1924). The estimated mean monthly flows for Patterson Creek vary from 16 cfs (October) to 257 cfs (June) (BLM, 1999a). Patterson Creek contains bull trout and westslope cutthroat trout (BLM, 1999a).

The Patterson Creek drainage is the only drainage in the subbasin to receive any kind of major mining activity. Tungsten ores were mined in the Blue Wing District of the Patterson Creek canyon near Inyo Creek. The Ima Mine operated sporadically from 1881 to 1958 and extracted tungsten, molybdenum, silver, copper, and lead (BLM, 1999a). Drainage from the mine site apparently continues to contribute excessive amounts of zinc to Patterson Creek (BLM, 1999a). There is an un-described mine site near Mahogany Creek between Patterson Creek and Falls Creek (BLM, 1999a).

2.4 Big Creek

The Big Creek subwatershed encompasses the entire Big Creek drainage including the North Fork Big Creek and South Fork Big Creek drainages in the Lemhi Range on the Salmon-Challis National Forest. Below the forest boundary, Big Creek is supplemented by Mill Creek and Stinking Creek subsurface flow.

Big Creek is one of the largest tributaries to the Pahsimeroi River with a drainage area approximately 70 square miles in size (Meinzer, 1924). Big Creek provides significant surface water flows to the Pahsimeroi River in high water years (ISCC, 1995). In 1924, Big Creek flowed to the Pahsimeroi River about 20 days out of the year (Meinzer, 1924). During that time, Big Creek lost more water to subsurface drainage then to irrigation diversions in the area below the canyon. The estimated mean monthly flows for Big Creek vary from 24 cfs (November) to 380 cfs (June) (BLM, 1999a).

Big Creek has bull trout, steelhead, and westslope cutthroat trout residing in it (BLM, 1999a).

2.5 Doublespring Creek

The Doublespring Creek subwatershed includes the Pahsimeroi River from Burnt Creek to Big Creek. This large subwatershed does not include Burnt Creek or Big Creek, but does include all of the Goldberg Creek drainage and the Doublespring Creek drainage. Goldberg Creek includes Donkey Creek and the Big Gulch area, and originates in the Donkey Hills and the Lemhi Mountains. Doublespring Creek originates in the Lost River Range and includes the Christian Gulch area.

The Doublespring Creek drainage is unique in that the stream itself carries very little water in comparison to its drainage basin size and the amount of alluvium built up (Meinzer, 1924). Doublespring Creek contributes no direct surface flow to the Pahsimeroi River. Mountain drainage disappears underground in the Doublespring Creek canyon, emerges briefly near the mouth of the canyon, then disappears again (Chatters, 1982). Doublespring Creek enters into a system of limestone caverns and eventually emerges as springs along the valley bottom contributing water to the Pahsimeroi River near the mouth of Goldberg Creek.

Goldberg Creek is one of the few perennial streams in the valley (Chatters, 1982), although no flow estimates were obtained. Meinzer (1924) reported that Big Gulch was a perennial stream in 1924. Goldberg Creek and Big Gulch contained bull trout; Donkey Creek contained westslope cutthroat trout and rainbow trout (BLM, 1999a).

An old, inactive gold mine exists in the area between Goldberg Creek and the upper Pahsimeroi River (BLM, 1999a).

2.6 Headwaters of the Pahsimeroi River

The headwaters subwatershed includes the Pahsimeroi River from its headwaters in the Lost River Range to, and including Burnt Creek. Tributaries in this subwatershed include Mahogany Creek, Rock Creek, the West Fork Pahsimeroi River, the East Fork Pahsimeroi River, and the Burnt Creek drainage. Tributaries in the Burnt Creek drainage include Long Creek, Short Creek, Baby Creek, Elkhorn Creek, and Poison Springs.

The upper Pahsimeroi River drainage including Mahogany Creek and Burnt Creek is about 100 square miles in size (Meinzer, 1924). These streams are largely mountainous snowmelt runoff - dominated systems, which are typically high gradient, high energy streams originating from numerous springs and seeps. The streams begin to lose water rapidly to subsurface flow as they exit canyon areas and enter alluvial deposits. The estimated mean monthly flows for Mahogany Creek range from 6 cfs (December) to 78 cfs (June), and for Burnt Creek these flows range from 7 cfs (December) to 116 cfs (June) (BLM, 1999a).

Bull trout are present in the Pahsimeroi River above Big Creek and in Mahogany Creek and Burnt Creek (BLM, 1999a). The same source lists rainbow trout present in Short Creek.

3.0 Water Quality Concerns And Status

3.1 Water Quality-limited Waters

In 1998, DEQ established a new 303(d) list based on 1993-1996 assessments performed through the Beneficial Use Reconnaissance Program (BURP) and other pertinent material regarding beneficial use status and water quality standards violations. Waters monitored through BURP after 1996 have not been assessed for 303(d) listing purposes. The 1998 303(d) list included five stream segments in the Pahsimeroi River subbasin (Table 6 and Figure 7). The U.S. Environmental Protection Agency (EPA) approved that list in May 2000. A stream status of "threatened" implies that water quality standards violations are impending, but have not yet occurred.

3.2 Water Quality Standards

Water quality standards are legally enforceable rules and consist of three parts: the designated uses of waters, the numeric or narrative criteria to protect those uses, and an antidegradation policy. Water quality criteria used to protect beneficial uses include narrative "free form" criteria applicable to all waters (IDAPA 58.01.02.200), and numerical criteria that vary according to beneficial uses (IDAPA 58.01.02.250, 251, and 252). Typical numeric criteria include bacteriological criteria for recreational uses, physical and chemical criteria for aquatic life (e.g., pH, temperature, dissolved oxygen, ammonia, toxics, etc.), and toxics and turbidity criteria for water supplies. Idaho's water quality standards are published in the state's rules at *IDAPA 58.01.02 B Water Quality Standards and Wastewater Treatment Requirements.* Designated beneficial uses for waters in the Pahsimeroi River subbasin are listed in Table 7.

Table 6 1998 303(d) listed stream segments for the Pahsimeroi River (17060202) subbasin.

Stream	Boundaries	Pollutant(s)
Pahsimeroi River	Dowton Lane to Salmon River	Nutrients, sediment (threatened)
Pahsimeroi River	Mahogany Cr. to Dowton Lane	Nutrients, sediment (threatened)
Patterson Creek	Inyo Creek to Pahsimeroi River	Sediment, flow alteration
Morse Creek	Forest boundary to Pahsimeroi River	Sediment, nutrient, flow alt.
Big Creek	Forest boundary to Pahsimeroi River	Sediment, nutrient

Table 7 Waters with designated beneficial uses in the Idaho Water Quality Standards.

Map Code	Water Body	Designated Uses
S-1, S-2, S-7, S-8, S-10, S-11, S-17, S-18	Pahsimeroi River – 8 units from Mahogany Creek to Salmon River	Domestic water supply, cold water biota, salmonid spawning, primary contact recreation, special resource water

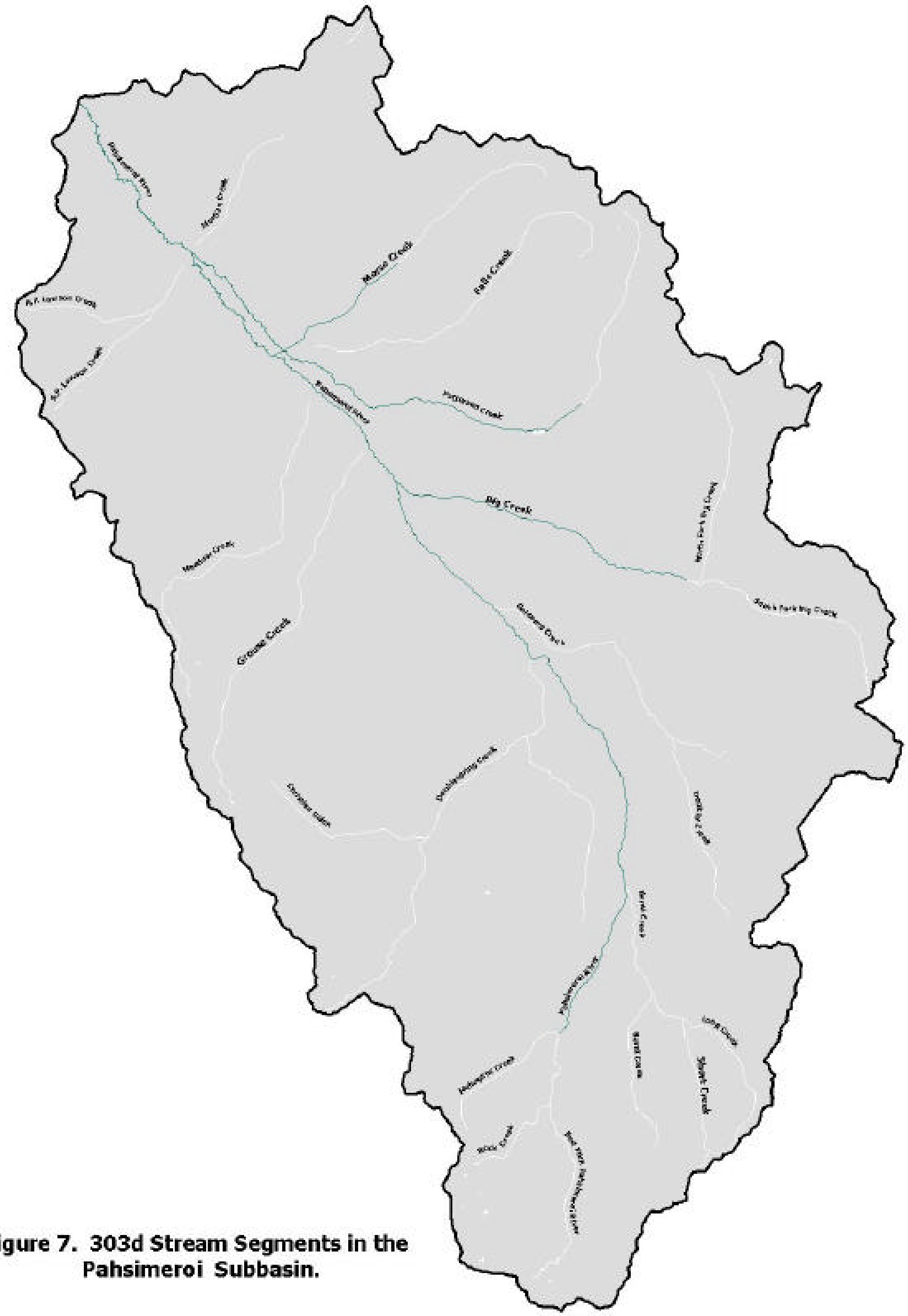

Figure 7. 303d Stream Segments in the Pahsimeroi Subbasin.

Waters not specifically designated in the Idaho water quality standards are undesignated waters (IDAPA 58.01.02.101), which are generally protected for coldwater aquatic life use and primary or secondary contact recreation until designated. In this case, all tributaries to the Pahsimeroi River are undesignated waters. Additionally, all waters of the state are designated for agricultural and industrial water supplies, wildlife and aesthetics.

Of particular importance regarding listed water bodies in this subbasin are the criteria for sediment and nutrients. The narrative criterion for sediment is as follows:

> "Sediment shall not exceed quantities specified in section 250, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determination of impairment shall be based on water quality monitoring and surveillance and the information utilized in section 350.02.b."

Quantities specified in section 250 refer to turbidity criteria identified for cold water biota use and small public domestic water supplies. Turbidity must be measured upstream and downstream from a sediment input in order to determine violation of criteria. Indirectly, specific sediment criteria also include intergravel dissolved oxygen measures for salmonid spawning uses. Intergravels filled with sediment cannot hold enough dissolved oxygen for successful incubation. Intergravel dissolved oxygen measurement requires the placement of special apparatus in spawning gravels. Turbidity and intergravel dissolved oxygen are rarely measured as part of routine reconnaissance-level monitoring and assessment. These measurements are usually conducted in special cases during higher-level investigations of potential problems. Because of access difficulty, such techniques are rarely used in the backcountry settings comprising most of this subbasin.

Because of the lack of specific numeric criteria for sediment, surrogate measures are often used as a mechanism to reflect potential sediment problems. Often the percentage of depth fine sediments found in spawning gravels is used as an indicator of sediment problems that will affect salmonid species. Generally, depth fines greater than 28-30% are considered unhealthful for spawning gravels. Bank stability can be another indicator of sediment problems in streams. When bank stability falls below 80%, these banks may be contributing unhealthy levels of sediment to aquatic habitats. There are other surrogate measures for sediment; however, caution is advised as specific levels can be highly variable depending on stream morphology and geology of the area, and it may be difficult to pinpoint levels that are universally acceptable.

The narrative criterion for nutrients is as follows:

> "Excess Nutrients. Surface Waters of the State shall be free from excess nutrients that can cause visible slime growth or other nuisance aquatic growths impairing designated beneficial uses."

The measures for excess nutrients that are often examined are total nitrogen, total phosphorus, chlorophyll-a, and turbidity. Although there is no maximum level specified by law, it is often recommended that total phosphorus as phosphorus should not exceed 50 micrograms per liter (ug/l) at the point where the stream enters a lake or reservoir, or 25 ug/l within the lake or reservoir (EPA Goldbook, 1986). The desired goal associated with these limits is to prevent eutrophication or nuisance algal growths in the water body. In some cases where phosphorus is not the limiting nutrient, total nitrogen values may give an indication of overall nutrient enrichment. Chlorophyll-a and turbidity measures relate to how much algae growth is occurring and causing cloudiness in the water.

Recreation uses in Idaho's water quality standards are protected through *Escherichia coli* (*E. coli*) bacteria criteria. Waters designated for primary contact recreation are not to contain *E. coli* bacteria significant to the public health in concentrations exceeding:

- a single sample of 406 *E. coli* organisms per 100 milliliters (ml), or

- a geometric mean of 126 *E. coli* organisms per 100 ml based on a minimum of five samples taken every three to five days over a 30 day period.

Waters designated for secondary contact recreation are not to contain *E. coli* bacteria significant to the public health in concentrations exceeding:

- a single sample of 576 *E. coli* organisms per 100 ml, or

- a geometric mean of 126 *E. coli* organisms per 100 ml based on a minimum of five samples taken every three to five days over a 30 day period.

Of particular importance in this subbasin is the relationship between water quality standards and intermittent waters. An intermittent water is defined (in IDAPA 58.01.02.003.51) as a water body that has a period of zero flow for at least one week in most years. Where flow records are available a stream with a 7Q2 flow of less than 0.1 cfs is considered intermittent. Section 070.07 of Idaho's water quality standards (IDAPA 58.01.02.070.07) addresses the application of water quality standards to these types of water bodies. Water quality standards in Idaho apply to intermittent waters during periods of optimum flow sufficient to support the beneficial uses for which the intermittent water body has been designated. In many cases, intermittent waters have not been designated and are protected for the default uses of cold water biota and secondary contact recreation. Optimum flow is described as at least 1 cfs for aquatic life (cold water aquatic life) and at least 5 cfs for recreation uses. When flows drop below these threshold values, water quality standards no longer apply to the water body.

The state water quality standards for temperature are found in State of Idaho Water Quality and Wastewater Treatment Administrative Rules (IDAPA 58.01.02.250.02.b). These require maintenance of the instantaneous maximum temperature below 13ºC (55.4ºF), and the maximum daily average temperature below 9ºC (48.2ºF) during spawning periods (Table 8). The period for salmonid spawning within the Pahsimeroi River is identified as occurring during the months of April and May for spawning steelhead and rainbow trout, and from the last week of August through September for Chinook Salmon.

The federal water quality standard for bull trout spawning and rearing temperature is found in the Code of Federal Regulations Title 40, Volume 14, Parts 87 to 135, section 131.33 (40CFR131.33).

Table 8 Summary of current stream temperature water quality standards in Idaho.

Source of Standard	Beneficial Use	Instantaneous (not to exceed)	Maximum Daily Average	7 Day Sliding Average of Daily Maximum
State of Idaho	Cold Water Biota	22º C 71.6º F	19º C 66.2º F	N/A
State of Idaho (seasonal by species)	Salmonid Spawning	13º C 55.4º F	9º C 48.2º F	N/A
State of Idaho (June – August)	Bull Trout Rearing	N/A	N/A	13º C 55.4º F
State of Idaho (September – October)	Bull Trout Spawning	N/A	9º C 48.2º F	N/A
EPA[1] (June – September)	Bull Trout Spawning and Rearing	N/A	N/A	10º C 50º F

[1] Applies to Pahsimeroi River above Big Creek.

The bull trout spawning and rearing temperature standard establishes a temperature criterion of 10ºC (50ºF), expressed as an average of daily maximum temperatures over a seven-day period, and applies to the Pahsimeroi River above Big Creek during the months of June, July, August, and September. The Pahsimeroi River is generally dewatered above Big Creek during this period and no TMDL based on federal water quality standards for this reach will be written.

3.3 Water Quality Assessments

DEQ BURP Assessments

Appendix A shows the number of sites in the Pahsimeroi subbasin that have been sampled through DEQ's BURP process. Only those data from 1996 and older have been assessed and used to create the 1998 303(d) list. The majority of sites in Appendix A were sampled in 1997 and 1998, and as such have not been assessed. However, using the macroinvertebrate biotic integrity (MBI) score and the habitat (HI) score as indicators, most sites are of reasonably good quality (MBI>3.5, HI>70). Assessment details regarding the streams that are listed on the 1998 303(d) list are discussed below.

Big Creek was 303(d) listed in 1998 from the National Forest boundary to the mouth. The only BURP assessment in that segment occurred four to five miles below the National Forest boundary (Table 9). It was assumed that the section of Big Creek above the impacted BURP site was also impacted due to similar land use (agriculture). Also of interest is the next BURP site downstream, a distance of approximately 4.5 miles, which was not assessed due to dry channel.

Multiple year classes of bull trout and cutthroat trout were collected in 1994 from undetermined locations within Big Creek by the Idaho Department of Fish and Game.

Morse Creek had two BURP sites in the National Forest and two sites below the National Forest boundary that were assessed (Table 10). One of the lower sites was directly below the forest boundary, and appeared to be fully supporting cold water biota based on scores. However, this site was included in the not full support category and the stream was 303(d) listed in 1998 from the Forest Service boundary to the mouth. In reality, the impacted section probably begins at the major diversion, which is only a few meters below the BURP site. No fish data were collected by DEQ,

Table 9 Big Creek BURP assessment.

BURP Site Location (elevation above mean sea level)	Assessment	MBI[1] Score	Habitat Score	Flow (cfs)	Year
Below confluence of North Fork and South Fork (6520 ft)	Full support above forest boundary (cold water biota, salmonid spawning)	5.04	88	61.2	1995 (Aug)
4-5 miles below forest boundary (5851 ft)	Not full support (cold water biota)	2.44	77	75	1995 (July)
~1.5 miles above Pahsimeroi River (5440 ft)	Not assessed			Dry channel	1995 (Aug)
North Fork above South Fork confluence (6559 ft)	Not assessed	5.85	114	40	1998 (Aug)
South Fork above North Fork confluence (6559 ft)	Not assessed	6.1	104	18	1998 (Aug)

[1] Macroinvertebrate biotic index

thus salmonid spawning was not an assessed use. According to the BLM (1999a), bull trout and cutthroat trout were surveyed in Morse Creek in 1994. Their existence is probably restricted to above the agricultural diversion.

The 1998 303(d) list identifies Patterson Creek as impacted from Inyo Creek to the mouth. The BURP site directly above Inyo Creek, although not assessed for the 1998 303(d) list, does show higher scores whereas the next BURP site approximately one mile further downstream and below the Ima Mine site had marginal macroinvertebrate scores (Table 11). No fish data were collected through BURP; however, the BLM (1999a) has identified bull trout and cutthroat trout in unspecified locations. Again, agricultural diversion and natural water loss probably restrict fish to upper reaches.

Most Pahsimeroi River BURP sites are higher elevation sites (Table 12). Only one site near the confluence with Doublespring Creek was near the valley; however, it was a dry channel in 1995 when it would have been sampled. Only one site was assessed for the 1998 303(d) listing. This site, as a result of good scores, led to the boundary change of this segment of the Pahsimeroi River (from “headwaters to Dowton Lane” to “Mahogany Creek to Dowton Lane”). Abundant fish data collected in the early 1990s indicated multiple year classes of bull trout in the upper watershed and multiple year classes of Chinook, rainbow/steelhead, brook trout, and mountain whitefish in lower reaches. The middle reaches of the Pahsimeroi River are typically dewatered during the summer from a combination of agricultural diversion and natural water loss. BLM (1999a) data indicated that bull trout and sculpin were found in the Pahsimeroi River above Big Creek in 1994.

Table 10 Morse Creek BURP assessment.

BURP Site Location (elevation above mean sea level)	Assessment	MBI[1] Score	Habitat Score	Flow (cfs)	Year
Above bridge at Morse Creek Campground (6280 ft)	Full support (cold water biota)	5.89	106	5.1	1994
Above bridge at Morse Creek Campground (6280 ft)	Full support (cold water biota)	4.92	110	78.2	1995
Below forest boundary (5889 ft)	Not full support (cold water biota)	4.99	95	74.5	1995
Above highway (5200 ft)	Not assessed			Dry channel	1994
Above highway (5200 ft)	Not full support (cold water biota)	3.34	57	9.8	1995

[1] Macroinvertebrate biotic index

Table 11 Patterson Creek BURP assessment.

BURP Site Location (elevation above mean sea level)	Assessment	MBI[1] Score	Habitat Score	Flow (cfs)	Year
Above East Fork confluence (6520 ft)	Full support (cold water biota)	4.12	84	25.7	1995
Above Inyo Creek (6320 ft)	Not assessed	4.56	117	26	1997
Between Ima Mine and Patterson (6120 ft)	Needs verification (cold water biota)	3.19	89	45.2	1995
Near BLM boundary in valley (5240 ft)	Not assessed			Dry channel	1995

[1] Macroinvertebrate biotic index

<u>BLM Assessments</u>

The Challis Field Office of the BLM has collected some recent water quality data in the Pahsimeroi subbasin. Appendix B includes two sets of data, the first of which includes water temperature, electrical conductivity, total dissolved solids, pH, and turbidity for selected streams in the subbasin. These data were a one-time sampling event in 1999. No standards violations were detected in the data. Also in Appendix B are Wolman pebble count data for selected streams in the subbasin. Mean percent surface fines vary from about 27% in Burnt and Donkey Creeks to as low as 12% in the Pahsimeroi River. Mean percent surface fines for three sites in the Pahsimeroi River are 15%, 11.7%, and 18.3%. No other 303(d) listed waters are represented in these data.

Table 12 Pahsimeroi River BURP assessment.

BURP Site Location (elevation above mean sea level)	Assessment	MBI[1] Score	Habitat Score	Flow (cfs)	Year
Below confluence of East and West Forks (7700 ft)	Full support (cold water biota, salmonid spawning)	4.42	84	59.6	1995
Below confluence of East and West Forks (7700 ft)	Not assessed	5.12	107	52.7	1998
Above road at Doublespring Pass (5900 ft)	Not assessed			Dry channel	1995
East Fork, 2.5 miles above confluence with West Fork (7950 ft)	Not assessed	5.45	86	19.5	1998
West Fork, above East Fork road (7760 ft)	Not assessed	5.55	100	13.5	1998

[1] Macroinvertebrate biotic index

The Challis Field Office of the BLM and the Salmon-Challis National Forest prepared a draft summary review of the Pahsimeroi subbasin to determine issues and areas of highest priority for watershed analysis to improve the resources (BLM/FS, 2000). They concluded that middle reaches of the Pahsimeroi River and the associated lower reaches of tributary streams are of highest priority for resource improvement for instream habitat. Tributaries included in this area are the lower sections of Morse Creek, Falls Creek, Big Creek, Lawson Creek, Trail Creek, Sulphur Creek, Grouse Creek, and Doublespring Creek, and all of Patterson and Goldberg Creeks. This region of the subbasin was targeted for instream habitat improvements primarily because of the irrigation diversion and dewatering that occurs in the lower reaches of all these tributaries. Higher elevation reaches of tributaries and the upper reaches of the Pahsimeroi River were considered of moderate priority for watershed analysis. The upper Morse Creek watershed was considered of low priority because the area already has strong fish populations and no immediate threats.

The following excerpts are from the *Pahsimeroi Watershed Biological Assessment* (BLM, 1999a):

> "Little empirical data exists on habitat quality for streams within the Pahsimeroi watershed. In general, aquatic habitat conditions on upper reaches of most streams, particularly those on Forest Service administered lands and within forested sections, reflect good conditions. Typically, those non-forested reaches accessible to livestock reflect degraded conditions to some degree. Condition trend is unknown for many

streams. As habitat objectives for streams within the watershed are developed, additional riparian and aquatic habitat monitoring sites will be established to monitor both aquatic and riparian habitat condition and trend to measure progress toward meeting these objectives."

"Portions of BLM administered segments of Mahogany Creek, Burnt Creek, Donkey Creek and the upper Pahsimeroi River were surveyed from 1995 through 1997 following R1/R4 habitat inventory protocols (Overton, et al 1995)(Table IVa [Table 13]). These inventories initiated intensive aquatic and riparian habitat evaluation and monitoring in the Pahsimeroi watershed to determine existing habitat conditions in perennial streams and to evaluate progress toward meeting desired future condition objectives patterned after PACFISH. These evaluations are conducted on key areas following protocols identified in Cowley (1992). Results indicate degraded bank and aquatic conditions for all streams surveyed, except for those reaches located within the Burnt Creek exclosures. R1/R4 protocols will be followed for all perennial streams containing sensitive fish species within the Pahsimeroi watershed, and may eventually be applied to all perennial streams."

"Burnt Creek and Mahogany Creek were further surveyed in 1998 using a modified R1/R4 developed by Model Watershed (Table IVb [Table 14]). These procedures provide less detailed information but are much faster to perform. Data is captured by category instead of quantifiably measured. Although not directly comparable to the R1/R4 methodology, certain parameters are comparable. This method may be useful to detect changes in stream morphology which then may initiate a full R1/R4 survey."

"An analysis of sediment delivery from Little Morgan, Morse, Falls, Patterson, Big, and Goldburg creeks and upper Pahsimeroi River, indicates that there are only slight amounts of suspended sediments delivered to the main Pahsimeroi River from these streams (Young and Harenberg 1973). Of those streams sampled, Grouse Creek carried the heaviest load of suspended sediment per volume of water; although, none of the streams contained excessive amounts. Grouse Creek does not enter the Pahsimeroi River except on rare occasions when high runoff events occur. Also, water chemistry and water quality measurements taken during the same period on these streams indicated that all streams appear to fall within normal and expected ranges for their respective soil and landform types. The major source of pollutants or contaminants currently appears to be effluent from irrigated pastures. Runoff from livestock concentration or use areas also contributes minor amounts of effluent. There is considerable sediment, however, delivered into the Pahsimeroi River from Pahsimeroi River stream bank erosion and bank shearing from private lands (Swift 1995)."

"Macroinvertebrate populations are considered indicators of short and long term habitat trends. The BLM began macroinvertebrate sampling in 1993 on selected streams (Attachment 1 Monitoring Protocols). Sampling was repeated as staffing and

Table 13 R1/R4 habitat inventory results for selected streams in the Pahsimeroi River Watershed, 1995 through 1997.

Stream	Habitat Units (N)	Grad-ient (%)	Length (ft)	Mean Width (ft)	Pools (%)	Max. Depth (ft)	Overall Width/ Depth Ratio	Scour Pool Width /Depth Ratio	LWD (#)	Bank Stability Percent	Under Cut Banks (%)	Surface Fines Percent
Mahogany Creek (95) KA-1	13	0.5	212.7	7.7	53.7	1.38	17.6	4.5	8.0	38.5	22.5	19.4
Burnt Cr. (95) KA-1	20	1.6	468.6	8.2	56.1	1.51	18.9	5.1	2.3	33.3	12.4	27.1
Pahsimeroi River (96) KA-3	8	1.8	1169.2	20.8	9.6	0.96	33.6	10.6	0.0	70.2	11.6	11.7
Pahsimeroi River (96) KA-4	5	1.8	446.5	18.0	40.7	1.67	22.9	5.9	0.0	70.2	17.7	15.0
Burnt Cr. Exclosure #6 (96)	47	2.4	1415.1	5.6	36.2	0.68	18.1	5.1	0.0	86.0	27.7	21.3
Burnt Cr. (96) KA-4	9	2.4	944.7	8.9	7.3	0.34	22.7	9.0	0.0	61.8	2.4	16.1
Donkey Cr. (96) KA-1	35	1.8	709.6	2.7	37.1	0.50	15.0	3.2	0.0	46.6	15.0	27.0
Burnt Cr. (97) KA-1	20	1.6	722.5	6.6	40.1	0.50	18.2	6.8	0.0	49.5	21.6	73.8
Burnt Cr. (97) KA-4	89	0.07	3501.1	6.1	25.0	1.13	17.3	5.5	1.5	77.9	23.8	27.7
Pahsimeroi River (97) "Sinks"	115	0.013	7830.2	18.5	27.7	2.48	34.5	5.4	27.6	36.1	5.0	18.3

KA=key area; N=number of habitat units sampled; Gradient=rise/run (estimated from USGS quad maps); Length=total length of sample; Mean Width=average of all habitat unit widths sampled; Pools=length of pool habitats sampled/total length sampled; Max Depth=mean residual pool depth of all reach samples; Overall Width:Depth Ratio=Ratio of mean width and depth of all habitat types in sampled reach; Scour Pool Width/Depth Ratio=mean width and mean max depth of all scour pools in sampled reach; LWD=Large Woody Debns, as woody debris 0.3 feet in diameter and 2/3 the bankfull width; Bank Stability; Bank Stability=Percent of stream bank displaying stable characteristics; Undercut Bank=Percent of stream bank with less than 90 degree angle (undercut); Surface Fines=Ocular estimate of wetted substrate less than 6mm in diameter.

budget permitted up through 1998. Samples are taken from riffles using a Surber sampler net and are sent to an independent laboratory for analysis. EPT are orders of aquatic insects that represent non-polluted water. Richness is a measure of the number of distinct taxa while abundance is a measure of density (number per unit area). The MBHI is an overall summary index of pollution tolerant and intolerant insects within the sample.

"Beginning in 1996, the laboratory no longer analyzed individual pollution tolerant or intolerant richness or abundance [as shown as NA on Table 15 below]. Initial samples collected from three sites on Burnt Creek, a tributary of the upper Pahsimeroi River, found that the stream failed to meet all but one standard for good habitat quality [Table 15]. Mahogany Creek was sampled in 1995 and found to be in

Table 14 Model watershed modified R1/R4 habitat inventory results for selected streams in the Pahsimeroi River Watershed, 1998.

Stream	Habitat Units (N)	Length (ft)	Mean Width (ft)	Overall width/ Depth ratio	Bank Stability Percent
Burnt Creek between Excl 3 & 4 (KA-1)	49	7451	6.2	9.7	56.2
Burnt Creek Excl #4	22	2990	5.5	5.8	69.4
Burnt Creek between Excl 4 & 5	43	5341	7.1	8.3	47.8
Burnt Creek Excl #5	42	3428	6.8	7.3	42.5
Burnt Creek between Excl 5 & 6 (KA-3)	30	5370	7.0	9.0	10.9
Burnt Creek Excl #6	40	5215	5.1	10.9	78.0
Burnt Creek between Excl 6 & 7 (KA-4)	27	4789	7.8	21.8	11.5
Burnt Creek Excl #7	8	918	2.8	5.8	100.0
Mahogany Creek diversion to fence	40	4491	7.0	9.1	19.6
Mahogany Creek above fence	47	3831	5.8	9.1	58.4

KA=key area; N=number of habitat units sampled; Length=Total length of sampled stream reaches; Mean Width=weighted average of all habitat unit widths sampled; Overall Width:Depth Ratio=Ratio of weighted mean width and depth of all habitat types sampled; Bank Stability=Percent of stream bank displaying stable characteristics.

good condition, meeting four of seven standards. Later samples showed some improvement in aquatic insect populations in Burnt Creek and static trends in Mahogany Creek. MBHI stayed relatively constant ranging between 2 and 4 indicating slightly polluted. In general, based on studies in other watersheds within the resource area, streams which have been adversely affected by livestock grazing reflect poor macroinvertebrate population indices. Those streams unaffected by livestock, or other human activities, generally meet or exceed DFC indices values; indices developed from analyzing representative samples from excluded, relatively healthy aquatic systems. It should also be noted that these indices are also very susceptible to high flow events, temperature extremes, timing of sampling, and sample error."

Table 15. Macroinvertebrate richness and abundance indices for sites on Burnt Creek and Mahogany Creek (bold numbers are standards met or exceeded).

Indices: (DFC) Stream (year)	**Pollution Intolerant Richness ($60%)**	**Pollution Intolerant Abundance ($60%)**	**Pollution Tolerant Richness (#20%)**	**Pollution Tolerant Abundance (#20%)**	**EPT Richness ($70%)**	**EPT Abundance ($80%)**	**MHBI (#2.00)**
Big Creek KA-1 (97)	NA	NA	NA	NA	64.5	**91.5**	3.53
Burnt Creek Excl #7 (93)	33.3	10.7	**16.7**	48.5	33.3	10.7	5.46
Burnt Creek Excl #7 (97)	NA	NA	NA	NA	50.0	10.6	3.45
Burnt Creek (1993)*	42.1	59.5	26.3	28.2	68.4	73.8	3.43
Burnt Creek KA-1 (95)	45.5	5.2	22.7	33.8	59.1	27.3	3.74
Burnt Creek KA-1 (96)	NA	NA	NA	NA	60.0	51.1	4.08
Burnt Creek KA-1 (97)	NA	NA	NA	NA	**70.0**	26.0	4.56
Burnt Creek KA-4 (96)	NA	NA	NA	NA	**76.0**	**82.1**	3.63
Burnt Creek KA-4 (97)	NA	NA	NA	NA	**75.0**	**81.0**	3.51
Burnt Creek Excl #1 (97)	NA	NA	NA	NA	52.9	20.9	5.33
Burnt Creek Excl #6 (97)	NA	NA	NA	NA	56.7	57.8	3.58
Donkey Cr. KA-1 (96)	NA	NA	NA	NA	54.1	53.7	3.17
Mahogany Cr. KA-1 (95)	52.9	**73.2**	**11.8**	**19.0**	64.7	**89.6**	2.82
Mahogany Cr. KA-1 (96)	NA	NA	NA	NA	57.7	35.7	3.57
Mahogany Cr. KA-1 (97)	NA	NA	NA	NA	57.7	76.7	3.52
Pahsimeroi River KA-3 (96)	NA	NA	NA	NA	68.4	**90.0**	3.41
Pahsimeroi River KA-3 (97)	NA	NA	NA	NA	**70.0**	**88.1**	2.80
Pahsimeroi River KA-4 (96)	NA	NA	NA	NA	63.6	45.3	4.75
Pahsimeroi River KA-4 (97)	NA	NA	NA	NA	68.4	76.6	4.17
Patterson Cr. KA-1 (97)	NA	NA	NA	NA	65.4	**81.6**	3.77

'1993 Data collected from area outside of exclosures
DFC=Desired Future Condition; EPT=Orders Ephemeroptera, Plecoptera, Tricoptera; MHBI=Modified Hilsenhoff Biotic Index

The BLM has monitored water temperature in a number of streams in the Pahsimeroi River subbasin over the past several years (BLM, 1999b; see Appendix D). In general, the streams are relatively cool in the mountains and the tops of alluvial fans until they reach the valley flow where they warm up in summer due to low flow and exposure to the sun. Since the mid-1990s, Long Creek (in 1997), Burnt Creek (in 1999), and Donkey Creek (in 1999) have been the only streams to exceed 22^{o} C with their highest recorded temperatures. Most tributary streams on BLM land had relatively warm temperatures during the summer months, and then experience substantial drops in temperature around the first of September, likely in response to seasonal changing air temperatures. These streams typically remain below 20^{o} C throughout the summer and often meet salmonid spawning temperatures (13^{o} C daily maximum, 9^{o} C daily average) in September and/or October. Mahogany Creek and Morse Creek can meet salmonid spawning temperatures all summer long at the point of monitoring (usually the top of the alluvial fan). Only Patterson Creek met the federal standard of 10^{o} C (7-day moving average of daily maximums) for bull trout in 1999. It is likely that Ditch Creek, Little Morgan Creek, Mahogany Creek, Morse Creek, the Pahsimeroi River above Mahogany Creek, and Patterson Creek could also meet the state temperature standards for bull trout (12^{o} C daily average in summer; 13^{o} C daily maximum and 9^{o} C daily average in September and October). Short Creek came close to meeting state criteria in 1999 with a daily average of 13^{o} C during the summer. The BLM described these same data as follows:

> "A program of measuring water temperatures in many of the streams in the watershed, using constant recording thermographs, was begun in 1994. Due to high water, however, several thermographs were lost in 1995 and these data sets were lost. Late fall low water levels also resulted in faulty data in 1998. Table VI [Appendix D] displays the available data obtained from 1994 through 1998. These data were compared against standards in PACFISH and Bull Trout Conservation Strategies (PACFISH 1995; INFISH 1995; Bull Trout Conservation Strategy 1995). Thresholds which should not be exceeded were: Chinook salmon - a seven day moving average of daily maximum temperatures of 64^{o} F [18^{o} C] for rearing and migration and a seven day moving average of daily maximum temperatures of 60^{o} F [16^{o} C] for spawning; Bull Trout - a seven day moving average of daily maximum temperatures of 59^{o} F [15^{o} C] for migration/holding, a seven day moving average of daily maximum temperatures of 54^{o} F [12^{o} C] for rearing, a seven day moving average of daily maximum temperatures of 48^{o} F [9^{o} C] for spawning, and a seven day moving average of daily maximum temperatures of 41^{o} F [5^{o} C] for incubation. Refer to Temperature Charts in Appendix for a depiction of the 7-day moving average and daily high temperatures for those streams with thermographs." (BLM, 1999a)

> "Results of the few streams measured in 1994, 1995 and 1996 indicate that all streams but Short Creek meet PACFISH standards for salmon rearing and migration and only Little Morgan Creek, Mahogany Creek and Pahsimeroi River complied with salmon spawning requirements. Little Morgan Creek, Mahogany Creek, and Pahsimeroi River met bull trout migration requirements but failed to meet rearing requirements. More recent data obtained in 1997 and 1998 followed similar trends. Few systems met the 48 ^{o} F [9^{o} C] bull trout spawning requirements, however, during the period of spawning (late September) and incubation (October-December) the

> critical temperatures are likely not being exceeded. The thermographs are removed prior to these critical times and the number of days indicated as exceeding the temperature standards are cumulative throughout the summer months. The high number of failed thermographs indicated as NO DATA was due to high flows when the thermographs were placed in the stream followed by exceptionally low flows. This situation left the thermographs high and dry out of the stream channel." (BLM, 1999a)

> "Based on observations in 1992-1998 in the Pahsimeroi watershed, it is likely that Little Morgan Creek, Tater Creek, Morse Creek, Falls Creek, Patterson Creek, Big Creek, Goldburg/Big Gulch Creek, Ditch Creek, Mahogany Creek and the upper Pahsimeroi River comply with both salmon and bull trout temperature requirements under most circumstances. It is the smaller streams without sufficient vegetative cover that reflect poor temperature regimes. These include Burnt Creek, Long Creek and Short Creek. Another factor influencing temperatures in these streams is the low flow volume combined with effects of ambient air temperatures." (BLM, 1999a)

It is important to point out that the "thresholds" just described are not related to the state's water quality standards, and are not equivalent to these standards. Not only do specific values differ for certain species and life stages, but the method of calculation differs quite often. State standards often use daily average calculations, not seven-day moving averages of daily maximum temperatures. The draft bull trout problem assessment concluded from BLM's data that most bull trout tributaries in the subbasin, including Little Morgan, Tater, Morse, Falls, Patterson, Big, Goldberg/Big Gulch, Ditch, and Mahogany Creeks, and the upper Pahsimeroi River, comply with both salmon and bull trout temperature requirements under most circumstances (USRITAT, 1999). This problem assessment also indicated that Burnt Creek, Long Creek, and Short Creek lack sufficient vegetative cover to produce adequate temperature regimes (USRITAT, 1999).

Most of the fish-bearing segments of streams are in the mountainous regions above any de-watering segments. These areas appear cool enough to support salmonid spawning; therefore, temperature does not seem to be affecting this beneficial use. Lower reaches that are affected by flow alteration or natural water loss are obviously affected by temperature. Should hydrologic connections be restored in these areas, then temperature may become an issue related to safe passage for salmonid migration.

The Department of Environmental Quality was able to obtain some quantitative temperature data from the Idaho Department of Fish and Game's Pahsimeroi River Hatchery. The IDFG temperature data is adequate to show that the Pahsimeroi River exceeds state temperature standards for salmonid spawning, and a load reduction based on applicable water quality standards can be formulated to show the percent reduction in water temperature needed to bring the Pahsimeroi River into compliance with state water quality standards. The cause of temperature loading is strongly related to flow alteration due to irrigation diversions and irrigation return flow as well as removal of riparian vegetation from overgrazing along certain reaches. At such time that flow is restored to these streams further analysis of temperature loading can be undertaken.

The BLM's Proper Functioning Condition ratings for the Pahsimeroi subbasin are listed in Appendix E (from BLM, 1999a). Of the 1998 303(d) listed streams, the Pahsimeroi River and Patterson Creek were identified as "functioning at risk" and Big Creek and Morse Creek were identified as in "proper functioning condition."

USGS Assessments

Appendix C lists water quality data (nutrients, sediment, temperature) collected at various U.S. Geological Survey stations throughout the subbasin since 1971. Measurements are very sporadic, and in general show no specific criteria violations. However, in recent years total phosphorus has been periodically greater than 0.05 mg/l (50 ug/l) at station #13302005, the Pahsimeroi River at Ellis, ID. These data suggest the possibility of nutrient enrichment at the mouth of the Pahsimeroi River.

Environmental Science and Research Foundation Contract

During the summer of 2000, a contractor for DEQ sampled nutrients and bacteria quantities in the Pahsimeroi River, Morse Creek, and Big Creek (Blew, 2000). Sediment sampling also took place on Pahsimeroi River, Morse Creek, and Patterson Creek. The McNeil core sediment sampling showed depth fines (<6 mm) in excess of 50% in Patterson Creek and at one sample site in the middle Pahsimeroi River. Morse Creek and upper Pahsimeroi River had 32% and 34% depth fine sediments, respectively.

E. coli and fecal coliform samples were taken from several locations within the Pahsimeroi River as well as in Morse Creek and Big Creek, on June 8, 2000, or August 17, 2000 (Blew, 2000). All *E. coli* samples from the Pahsimeroi River on June 8, 2000 exceeded state bacteriological standards for primary contact recreation (standard = 406 colony forming units (cfu)/100 as a single sample). *E. coli* samples on that day ranged from 547.5 cfu/100 to 1413.6 cfu/100. Big Creek also had a high *E. coli* sample on June 8, 2000 (488.4 cfu/100); however, the sample was taken from an irrigation diversion because the creek bed was dry. Total phosphorus samples were also high at two locations in the Pahsimeroi River (0.15 – 0.43 mg/l). Morse Creek had much lower sample values for bacteria and nutrients.

Follow-up sampling during July of 2001 at two sites on the Pahsimeroi River were below water quality standards: 200 cfu/100 ml on 7/27/01 at Dowton Lane and 150 cfu/100 ml on 7/27/01 at the USGS gauging station just above the Salmon River confluence. DEQ will continue monitoring e-coli in conjunction with wadable and large river Beneficial Use Reconnaissance Program monitoring at an additional site on the lower river to evaluate the potential need for a TMDL for pathogens in the future.

Blew (2000) also conducted stream and road erosion surveys at two sites on the Pahsimeroi River and one site each on Big Creek and Patterson Creek. Erosion severity was rated as severe to moderate for the two Pahsimeroi River sites primarily due to trampling by cattle. Big Creek and Patterson Creek were rated as having moderate erosion severity. Big Creek may have been affected by a flow event in the recent past. Patterson Creek showed signs of down cutting.

Idaho Model Watershed

The Idaho *Model Watershed Plan* (ISCC, 1995) indicates that the two major limiting factors affecting salmon and steelhead habitat in the Pahsimeroi River are: 1) the insufficient flows for adult migration below the Ellis diversion, and 2) high sediment levels in spawning gravels caused by poor stream bank stability, head cutting at Sulphur Creek, and diversion structures needing improvements. The plan reports cobble embeddedness in the Pahsimeroi River is approximately 50%. The Patterson Creek/Big Springs Creek area has similar major limiting factors (ISCC, 1995). Additionally, the plan reports that streamside cover and barrier-free migration for juvenile out-migration need improvement.

3.4 Assessment Data Gaps

In general, the amount of information applicable to the listed segments of streams on the 1998 303(d) list is sparse. The listed segments are generally below National Forest boundaries, which often coincide with the point at which the stream leaves the mountains and enters the alluvial fans on the valley floor. Very few of these segments have been monitored through BURP, mainly because of a lack of flow. These streams are often diverted for agricultural irrigation, and some naturally enter the subsurface alluvial gravels. Additionally, there have been no BURP monitoring sites in listed segments of the Pahsimeroi River.

In its draft sub-basin review (BLM/FS, 2000) the BLM indicated that the middle reaches of the Pahsimeroi River and lower segments of Morse, Big, and Patterson Creeks were high priority for resource improvement to provide access for salmonid fishes. Again, this priority ranking is likely due to the dewatered nature of these portions of streams preventing pathways for fish migration.

The BLM has extensively surveyed Burnt Creek and Mahogany Creek and, to a lesser extent, Donkey Creek and the Pahsimeroi River. Their data suggest that these streams have substantial bank stability problems and sedimentation. In fact, the BLM has indicated that non-forested reaches of streams accessible to livestock are in a degraded condition (BLM, 1999a). It is not clear if the authors were referring to all such streams in the subbasin, or just a few streams. This information may or may not apply to the listed segments of Big, Morse, and Patterson Creeks.

Big Creek, Morse Creek, and Patterson Creek are all 303(d) listed for sediment pollution. Additionally, Big Creek and Morse Creek are listed for nutrient related pollution. Morse Creek and Patterson Creek are listed for flow alteration, although load allocations, and thus TMDLs, are not developable for flow alteration. One sample of depth fines in Patterson Creek indicated excessive fines (>50%) (Blew, 2000). One such sample in Morse Creek is less conclusive (32%). In general, there is insufficient information to determine if these streams are impacted by sediment and/or nutrients. At issue is the lack of flow. These streams may lack sufficient flow to be assessed extensively, and that lack of flow is probably the result of both natural and human-related causes.

The Pahsimeroi River from Mahogany Creek to its mouth is listed as threatened by nutrient and sediment pollution. BLM information suggests that the river is not impacted by sediment, largely because sediment-bearing streams do not sufficiently reach the Pahsimeroi River to deposit sediment. However, one depth fine measurement in a middle reach of the Pahsimeroi River showed excessive fines (>50%) (Blew, 2000), and excessive bank erosion has been described. Limited total phosphorus and total Kjeldahl nitrogen data does suggest that the Pahsimeroi River may carry excess nutrients; however, the extent of the problem needs further study. Bacteria may also be a problem in the Pahsimeroi River during spring runoff; however, more data are needed to adequately characterize the source and extent of the bacteria problem.

3.5 Pollutant Source Inventory

Pollution sources are primarily nonpoint source related and are probably all agricultural and grazing related. Much of this subbasin is used for grazing both as rangeland and as irrigated pasture. There is some irrigated pasture and crop production and a small amount of dryland crop production. The largest source of pollution is likely to be the usage of water, which dewaters streams and causes low flow conditions in the Pahsimeroi River. Such low flow conditions tend to concentrate pollutants of both natural and human-related origin.

There are two National Pollutant Discharge Elimination System (NPDES) permits in the subbasin according to the EPA permits compliance system (PCS) database. Both permits are for the Pahsimeroi River Rearing Ponds, a fish hatchery owned by Idaho Power and operated by the Idaho Department of Fish and Game. Permit # IDG130039, as listed in the PCS database, does not describe a specific discharge. This permit probably relates to general provisions under a general permit for hatcheries. Permit # ID0022527 describes discharges to the Pahsimeroi River during September through May, but no discharge during the summer months.

3.6 Pollutant Source Data Gap

Sediment and nutrient pollution may be from the same sources and linked at the particulate level. Some stream bank erosion surveys have been completed. Other sources of nutrients, such as feedlots and pastures, should be analyzed for possible contributions. These sources should also be investigated for possible bacteria contributions.

3.7 Summary of Pollution Control Efforts

The Idaho Model Watershed project has been implementing its goals to achieve better salmon and steelhead habitat and migration over the past five years. According to its website (www.modelwatershed.org), as of October 20, 2000, six projects have been implemented constructing 16 miles of fence to protect six miles of stream in the Pahsimeroi subbasin. Additionally, the project has eliminated a diversion structure through water rights transfer, which resulted in the reconnection of seven miles of habitat in the Pahsimeroi River.

The BLM uses a number of techniques to mitigate impacts from livestock grazing in the Pahsimeroi River subbasin (BLM, 1999a). PACFISH/INFISH standards and guides are used overall on all activities within the subbasin. The BLM will use photo point monitoring on streams inaccessible to livestock and operational grazing standards, long-term effectiveness monitoring, and photo point monitoring on accessible streams.

3.8 Summary

Patterson Creek, Inyo Creek to Mouth, Sediment and Flow Alteration

Patterson Creek below Inyo Creek is dewatered by diversions and natural subsurface flow. Flow occurs in this section only during high flow spring runoff. It is likely that insufficient flow is available to carry sediment. It is suggested that this section of Patterson Creek be listed for flow alteration only.

Morse Creek, Forest Boundary to Mouth, Sediment, Nutrients, and Flow Alteration

Morse Creek below the forest boundary is dewatered by diversions and natural subsurface flow. Flow occurs in this section only during high flow spring runoff. It is likely that insufficient flow is available to carry sediment. There is no evidence of nutrient enrichment in this stream. Upper Morse Creek is one of the more pristine streams in the subbasin. It is suggested that the lower section be listed for flow alteration only.

Big Creek, Forest Boundary to Mouth, Sediment and Nutrients

Big Creek below the forest boundary is dewatered by diversions and natural subsurface flow. Flow occurs in this section only during high flow spring runoff. It is likely that insufficient flow is available to carry sediment and nutrients in this section. It is suggested that this section be listed for flow alteration only.

Pahsimeroi River, Mahogany Creek to Dowton Lane and Dowton Lane to Salmon River, Threatened by Sediment and Nutrients

There is some evidence that bank erosion along the river itself may be contributing excess sediment to the Pahsimeroi River. Nutrients may be accumulating in the lowest reaches of the Pahsimeroi River, which are then exacerbated by low flow conditions. Likewise, limited bacteria sampling suggests high bacteria in spring high flows. The lack of hydrologic connections probably prevent tributaries from contributing sediment or nutrients to the river, thus all sources are likely internal. There may be sufficient information on stream bank erosion rates to calculate a potential sediment load. More nutrient and bacteriological information is needed to adequately characterize the extent of any problems. These pollutants may only be associated with spring runoff events, thus only those flows would contribute loadings. In addition, sources of nutrients and bacteria may be very site-specific.

Additional Concerns

Information suggests that Burnt Creek, Short Creek, and Long Creek may experience elevated water temperatures due to the lack of sufficient shading from streamside vegetation.

4.0 Pahsimeroi River TMDL

4.1 Loading Capacities and Targets

The current state of science does not allow specification of a sediment load or load capacity to meet the narrative criteria for sediment and to fully support beneficial uses for coldwater biota and salmonid spawning. All that can be said is that the load capacity lies somewhere between current loading and levels that relate to natural stream bank erosion levels. We presume that beneficial uses were or would be fully supported at natural background sediment loading rates that are assumed to equate to the 80% bank stability regimes required to meet state water quality standards.

Beneficial uses may be fully supported at higher rates of sediment loading. The strategy is to establish a declining trend in sediment load indicator targets, and to regularly monitor water quality and beneficial use support status. If it is established that full support of beneficial uses is achieved at intermediate sediment loads above natural background levels, and that narrative sediment standards are being met the TMDL will be revised accordingly.

Elevated stream temperature can affect the success of salmonid spawning, overall distribution and survival of salmonids and the presence and type of macroinvertebrate species in streams. State of Idaho Water Quality Standards for temperature have been adopted to support coldwater biota and salmonid spawning beneficial uses during the critical periods of the year when stream temperatures are naturally elevated. Likewise the US Environmental Protection Agency Water Quality Standards for temperature have been adopted to support bull trout spawning and rearing beneficial uses during the critical periods of the year when stream temperatures are naturally elevated. Additional elevation of stream temperature can result from human activities that affect streams by reducing shading plants, increasing the surface area (width) of the stream exposed to sunlight, or returning water used for agricultural purposes to the Pahsimeroi River at temperatures above those specified in state or federal Water Quality Standards.

The observed heat load within the Pahsimeroi River varies slightly from year to year depending upon winter and summer precipitation, ambient air temperature and the percent of maximum potential solar radiation. The load capacity for heat for the purpose of this TMDL is determined by EPA water quality standards for temperature based on bull trout juvenile rearing and bull trout spawning, as numeric water quality standards must be supported in the absence of site-specific criteria, or alternative beneficial use designations. Water quality standards specific to bull trout are the most restrictive of current temperature standards, and at the level of compliance with bull trout temperature standards, other temperature standards for salmonid spawning and coldwater biota would be assumed to be met during the warmest period of the year. The target for stream temperature within the Pahsimeroi River is identified as the federal (EPA) bull trout temperature standard. It is assumed that the water quality standard for bull trout juvenile rearing and spawning also incorporates an implicit margin of safety adequate to insure self sustaining populations of all salmonids including bull trout.

Sediment Targets

To improve the quality of spawning substrate and rearing habitat in the Pahsimeroi River, it is necessary to reduce the component of subsurface fine sediment less than 6.35 mm to below 28%.

Temperature Targets

The state water quality standards for temperature are found in State of Idaho Water Quality and Wastewater Treatment Administrative Rules (IDAPA 58.01.02.250.02.b). To improve the quality of coldwater biota and salmonid spawning, particularly for anadramous steelhead and Chinook salmon and resident rainbow trout, within the Pahsimeroi River, it will be necessary to maintain the instantaneous maximum temperature below 13ºC (55.4ºF), and the maximum daily average temperature below 9ºC (48.2ºF) during spawning periods. The period for salmonid spawning within the Pahsimeroi River is identified as occurring during the months of April and May for spawning steelhead and rainbow trout, and from the last week of August through September for Chinook Salmon.

The federal water quality standard for bull trout spawning and rearing temperature is found in the Code of Federal Regulations Title 40, Volume 14, Parts 87 to 135, section 131.33 (40CFR131.33). The bull trout spawning and rearing temperature standard establishes a temperature criterion of 10ºC (50ºF), expressed as an average of daily maximum temperatures over a seven-day period, and applies to the Pahsimeroi River above Big Creek during the months of June, July, August, and

September. The Pahsimeroi River is generally dewatered above Big Creek during this period and no TMDL based on federal water quality standards for this reach will be written.

4.2 Loading Summary

Existing Sediment Sources

The primary source of sediment to the Pahsimeroi River has been identified as stream bank erosion (ISCC, 1995; Swift, 1995). The DEQ conducted stream bank erosion inventories from the confluence of Morgan Creek in the upper watershed to below Burstedt Lane (approximately 3 miles above the mouth of the Pahsimeroi) to estimate the amount of sediment loading to the Pahsimeroi River from stream bank erosion.

Historic overgrazing has accelerated stream bank erosion. Riparian management has been implemented in some areas resulting in improved conditions over limited areas, though increased stream bank erosion from overgrazing within the riparian vegetation zone remains the single most significant source of sediment to the Pahsimeroi River. The stream bank erosion inventory conducted on the Pahsimeroi River shows that the primary source of sediment from stream bank erosion occurs over the upper evaluation reaches above Hooper Lane. Stream bank erosion below Hooper Lane is also significant, particularly because of the low gradient of the river over its course. The upper river is often naturally dry due to infiltration of flow into the alluvium substrate. This condition is often exacerbated by diversion of water for irrigation. During periods of peak flow the sediment from the upper reach that accumulates during the dewatered period is transported and deposited along lower gradients reaches. The erosive action of high water on unstable stream banks during peak flow also acts to increase erosion and transport of sediment to depositional reaches.

Reduction of stream bank erosion prescribed within this TMDL is directly linked to the improvement of riparian vegetation density and structure to armor stream banks, reduce lateral recession, trap sediment and reduce the erosive energy of the stream thus reducing sediment loading. In reaches that are down-cut, or that have vertical erosive banks, continued erosion will be necessary to re-establish a functional flood-plain that would subsequently be colonized with stabilizing riparian vegetation. This process could take many years. It is also expected that improvement of riparian vegetation density and structure would reduce the potential for temperature and bacteria loading in the future.

Existing Heat Sources

Energy responsible for elevating stream temperature enters the Pahsimeroi River, and irrigation ditches that return flow to the river, primarily through direct solar radiation such as sunlight directly striking the water. Geothermal inflow can also influence stream temperature, however, no discrete geothermal features have been identified that contribute flow to the lower Pahsimeroi River. Indirect scattered and reflected radiation from the sky and clouds and long-wave thermal radiation from the atmosphere also contribute to a lesser degree (Wetzel 1983). The accumulation of heat within a stream can be referred to as heat loading. Heat loading is a cumulative function; it increases along the course of a stream. Heat loading is reduced by riparian vegetation that is capable of shading the stream, and buffered by cooler water from tributaries and spring source inflow. Streams that have healthy riparian vegetation tend to have less heat loading because of direct shading. Additionally the surface area of streams with healthy riparian communities is often reduced due to lower width to depth ratios. Streams that have reduced riparian vegetation tend to have greater width to depth ratios resulting from streambank erosion that increases the width of the stream channel and reduces the depth of the stream channel. Reduced shade and increased stream surface area can result from historic and current flow alteration and inadequate grazing management practices within the riparian zone.

Reduction of streambank erosion prescribed within this TMDL is directly linked to the improvement of riparian vegetation density, vigor, and structure to armor stream banks, reduce lateral recession, trap sediment and reduce the erosive energy of the stream thus reducing sediment loading. It is also expected that improvement of riparian vegetation density, vigor, and structure would reduce the width of streambanks and increase stream shading, which would reduce stream heat loading. Heat loading from irrigation return water is likely a significant source as well, and could be addressed through voluntary implementation projects on private land.

<u>Estimates of Existing Load</u>
Based on estimates from stream bank erosion inventories on the Pahsimeroi River the existing accumulated stream bank erosion rate for the 17 inventory reaches including extrapolated reaches over the current 303(d) listed segment is 2,838 tons per year. The inventory reaches are distributed from the confluence of Mahogany Creek to just above the mouth of the Pahsimeroi River.

<u>Waste Load Allocation</u>
The only point source discharge in the Pahsimeroi River Watershed is the Idaho Power Company's Pahsimeroi River Rearing Ponds. The Pahsimeroi River Rearing Ponds, operated by the Idaho Department of Fish and Game, consist of two earthen, single pass rearing ponds with a large quiescent zone over the lower 1/3 of the ponds due to the nature of the pond design and the species of fish cultured (Chinook salmon). There are two large settling ponds below the two rearing ponds that are dredged annually with the dredge material spread over upland crop production land.

Fry are placed in the ponds in April or May of each year and fed with four stationary demand feeders. No pond cleaning or fish size grading that would re-suspend sediment occurs during the 10-11 month rearing cycle. "Harvesting" of fish at the Pahsimeroi facility consists of liberation of the anadromous Chinook stocks directly into the Pahsimeroi River. When fish are released, the level of the rearing and settling ponds are gradually lowered to prevent re-suspending sediment. After release, inflow is shut off, the ponds are allowed to dry, and deposited sediment is removed for land application. Solids that are deposited are not large quantities.

The NPDES permit for this facility identifies effluent limitations monitoring requirements and best management practices to minimize discharge of total suspended solids and settlable solids based on a daily average determined by monthly samples. The NPDES permit sets effluent limitations for suspended solids at a 5.0 mg/l daily average with a 15 mg/l daily maximum. The limitation for settleable solids is a 0.1 ml/l daily average evaluated from samples collected once per month.

Given the site-specific conditions found at this facility, it is felt that the NPDES permit is adequately protective of water quality at and below the point of discharge of hatchery effluent and that more restrictive limitations are not required at this time. Additionally, there will be no net increase of effluent limitations to the Pahsimeroi River from the Pahsimeroi hatchery rearing ponds.

Load Allocations

Using water quality targets identified in this TMDL sediment load allocations and sediment load reductions are outlined in this section. Because the primary chronic source of sediment loading to the Pahsimeroi River is stream bank erosion, quantitative allocations have been developed. These sediment load reductions are designed to meet the established instream water quality target of 28% or less fine sediment <6.35 mm in areas suitable for salmonid spawning. Stream bank erosion reductions are quantitatively linked to tons of sediment per year. An inferential link is identified to show how sediment load allocations will reduce subsurface fine sediment to or below target levels. This link assumes that by reducing chronic sources of sediment, there will be a decrease in subsurface fine sediment that will ultimately improve the status of beneficial uses. Stream bank erosion load allocation is based upon the assumption that natural background sediment production from stream banks equates to 80% stream bank stability as described in Overton et al. (1995), where stable banks are expressed as a percentage of the total estimated bank length. Natural condition stream bank stability potential is generally at 80% or greater for A, B, and C channel types in plutonic, volcanic, metamorphic and sedimentary geology types. Based on the existing sediment load from bank erosion on the Pahsimeroi River an overall reduction of 75% is recommended. Individual load reductions by reach range from 95% to 0%. Pahsimeroi River stream bank erosion load allocations are broken down by individual inventory segment in Table 16. Appendix F contains stream bank erosion inventory data for each of the inventory reaches as well as maps.

Available temperature data for development of the TMDL includes the maximum and minimum observed daily temperature and temperature readings collected at two hour or 4 hour intervals during select months of the year. The maximum observed daily temperature and the average daily temperature were calculated from temperature data collected in 1999 and 2000 by the Idaho Department of Fish and Game at the Pahsimeroi Hatchery using in-stream temperature data loggers.

The maximum instantaneous temperature and the daily average temperature observed at the Pahsimeroi Hatchery intake were used to determine the percent temperature reduction for the lower Pahsimeroi River (below Hooper Lane) to comply with temperature standards. The Pahsimeroi Hatchery intake point of diversion will be used as the point of compliance for this TMDL for temperature. It is assumed that by using a lower elevation point of compliance that higher elevation reaches will also be in compliance, and that over the remaining run of the Pahsimeroi River to the Salmon River there would be compliance with temperature criteria. The reduction was identified by subtracting the applicable criteria from the observed temperatures and calculating the percent reduction required to comply with the current state standard (Table 17). Maximum exceedances of the most restrictive criteria were used to identify needed temperature reductions based upon the assumption that if temperature reductions are directed at eliminating the maximum exceedance of the most restrictive criteria, any other exceedances of criteria will be eliminated during other seasons of the year.

For state salmonid spawning criteria the steelhead/rainbow trout spawning season’s (April and May) largest exceedance occurs in May 1999 with a maximum instantaneous temperature of 19.1ºC (66.4ºF) with 17 days exceedance. The maximum daily average criteria maximum exceedance for May is 14.9ºC (58.9ºF) with 19 days exceedance. This equates to a needed instantaneous maximum temperature reduction of 6ºC (11ºF) and a reduction in maximum daily average of 5.9ºC (10.7ºF).

Table 16 Sediment load allocations/reductions by erosion inventory reach.

Reach Number (from downstream to upstream)	Existing Erosion Rate (t/mi/y)	Total Erosion Rate (t/y)	Proposed Erosion Rate (t/mi/y)	Load Allocations (t/y)	Erosion Rate Percent Reduction	Percent of Total Erosion
1	1.8	6.0	2.2	7.7	0	<1
2	14.8	40.0	6.7	18.3	55	1
3	9.4	30.0	3.4	10.6	64	1
4	24.7	43.0	7.9	13.7	68	2
5	10.0	27.0	6.0	15.0	40	1
6	63.0	115.0	9.0	16.4	86	4
7	2.0	4.0	4.0	8.0	0	<1
8	15.0	43.0	6.0	16.0	60	2
9	111.0	60.0	7.0	4.0	94	2
10	92.0	65.0	13.0	9.6	86	2
11	67.0	236.0	11.0	39.3	84	8
12	2.2	1.2	2.2	1.2	0	0
13	40.0	21.0	7.0	3.5	83	1
14	2.0	1.0	2.0	1.6	0	<1
15	8.0	22.0	3.0	9.1	63	1
16	177.0	1291.0	73.0	531.0	59	45
17	147.0	833.0	7.0	39.0	95	29
Totals		**2838.2**		**744.1**	**74**	

For state salmonid spawning criteria the steelhead/rainbow trout spawning season's (April and May) largest exceedance occurs in May 1999 with a maximum instantaneous temperature of 19.1ºC (66.4ºF) with 17 days exceedance. The maximum daily average criteria maximum exceedance for May is 14.9ºC (58.9ºF) with 19 days exceedance. This equates to a needed instantaneous maximum temperature reduction of 6ºC (11ºF) and a reduction in maximum daily average of 5.9ºC (10.7ºF).

The Chinook salmon spawning season's (August and September) largest exceedance occurs in August 1999 with a maximum instantaneous temperature of 18.3ºC (65ºF) with 30 days exceedance. The maximum daily average criteria maximum exceedance for August 1999 is 15.1ºC (59.19ºF) with 29 days exceedance. The needed instantaneous maximum temperature reduction during Chinook spawning is 9.3ºC (9.6ºF) and a reduction in maximum daily average of 6.1ºC (10.9ºF).

<u>Margin of Safety</u>
The Margin of Safety (MOS) factored into load allocations for the Pahsimeroi River is implicit. The MOS includes the conservative assumptions used to develop existing sediment loads. Conservative assumptions made as part of the sediment loading analysis include: 1) desired bank erosion rates are representative of background conditions; 2) water quality targets for percent depth fines are consistent with values measured and set by local land management agencies based on established literature values and incorporate an adequate level of fry survival to provide for stable salmonid production.

Table 17 Maximum exceedances/necessary reductions for state water temperature standards.

Summary of Standard	Largest Exceedance	Necessary Reduction
State of Idaho steelhead/rainbow trout spawning season (April and May) maximum instantaneous temperature of 13º C (55.4º F)	May 1999 19.1º C (66.4º F) 17 days exceedance	6.1º C (10.9º F) 32% (17%)
State of Idaho steelhead/rainbow trout spawning season (April and May) maximum daily average temperature of 9º C (48.2º F)	May 1999 14.9º C (58.9º F) 19 days exceedance	5.9º C (10.7º F) 40% (18%)
State of Idaho chinook salmon spawning season (August and September) maximum instantaneous temperature of 13º C (55.4º F)	August 1999 18.3º C (65.0º F) 30 days exceedance	5.3º C (9.6º F) 29% (15%)
State of Idaho chinook salmon spawning season (August and September) maximum daily average temperature of 9º C (48.2º F)	August 1999 15.1º C (59.2º F) 29 days exceedance	6.1º C (10.9º F) 40% (18%)

The Margin of Safety factored into load allocations for water temperature are implicit within the state water quality standards. It is assumed that water quality standards incorporate a margin of safety adequate to protect for aquatic life beneficial uses within the Pahsimeroi River.

<u>Seasonal Variation and Critical Time Periods of Sediment Loading</u>

To qualify the seasonal and annual variability and critical timing of sediment loading, climate and hydrology must be considered. This sediment analysis characterizes sediment loads using average annual rates determined from empirical characteristics that developed over time within the influence of peak and base flow conditions. While deriving these estimates it is difficult to account for seasonal and annual variation within a particular time frame; however, the seasonal and annual variation is accounted for over the longer time frame under which observed conditions have developed.

Annual erosion and sediment delivery are functions of a climate where wet water years typically produce the highest sediment loads. Additionally, the annual average sediment load is not distributed equally throughout the year. Erosion typically occurs during a few critical months. For example, in the Pahsimeroi River watershed, most stream bank erosion occurs during spring runoff.

This sediment analysis uses empirically derived hydrologic concepts to help account for variation and critical time periods. First, field-based methods consider critical hydrologic mechanisms. For example stream bank erosion inventories account for the fact that most bank recession occurs during peak flow events when banks are saturated. Second, the estimated annual average sediment delivery from a given watershed is a function of bankfull discharge or the average annual peak flow event. Finally, it is assumed that the accumulation of sediment within dry channels is continuous until flow resumes and the accumulated sediment is transported and deposited.

5.0 Public Participation

The Challis Experimental Stewardship Group is the approved Watershed Advisory Group for the Upper Salmon and Pahsimeroi watersheds. On April 27th, 2001, a meeting was held in Challis, Idaho to present the Pahsimeroi Subbasin Assessment and TMDL to the Challis Experimental Stewardship Group. There were 31 names on the sign-in sheet, though there were more people in attendance.

The Challis Experimental Stewardship Group is a cooperative group consisting of citizens and agency representatives involved in issues relating to improving land management practices to enhance range conditions and associated water quality while protecting the cultural heritage and economics of the local community. The Challis Experimental Stewardship Group has been involved throughout the development period of the Pahsimeroi Subbasin Assessment and TMDL, as well as the Upper Salmon Subbasin Review, and the Upper Salmon River Bull Trout Key Watershed Problem Assessment that included the Pahsimeroi River watershed.

The Pahsimeroi River Subbasin Assessment has been distributed to members of the Experimental Stewardship Program, land management agencies, Custer Soil and Water Conservation District board members, and the interested public that have requested the document. The Pahsimeroi River Subbasin Assessment and TMDL was distributed to the same individuals during the 30-day public comment period for their review.

Comments and the response to comments were incorporated into the Final Draft of the Pahsimeroi River Subbasin Assessment and TMDL for submission to the EPA for approval. The following comments were received and addressed.

Comments from Rick Philps, Chairman of the Challis Experimental Stewardship Program

1) *A list of all the acronyms used in the document might make it somewhat easier to understand. For example, on page 23 paragraph 4 what is the definition of 7Q2.*

   We will add 7Q2 and it's definition to the Pahsimeroi River TMDL Glossary. 7Q2 is a term used in the State Water Quality Standard to express the lowest 7 day average flow with an average frequency of recurrence of every 2 years.

2) *On page 24 Table 7 what do the measurements in feet, in the first column represent?*

   We will show in the table that the measurements in feet represent elevation.

3) *On page 31 paragraph 2 and 3 use either metric or English units. It is confusing jumping from one to the other.*

   Paragraph 2 represents the text of the TMDL and uses metric units. Paragraph 3 is an excerpt from another document that uses English units. We have tried to use metrics where possible throughout the document. We will bracket the metric unit equivalent within the excerpt.

4) *On page 3 paragraph 2 is there any data that shows the amount of sediment that is transported out of the Pahsimeroi River and delivered to the Salmon River? How much sediment can the Pahsimeroi River transport out of the system without increasing the fines?*

   In the process of developing the Middle Salmon River-Panther Creek Subbasin Assessment and TMDL (the document that covers the Salmon River from the confluence of the Pahsimeroi downstream to the confluence of the North Fork of the Salmon River) we did not find any data that indicated the sediment load to the Salmon River contributed by the Pahsimeroi River.

   Within the Pahsimeroi River TMDL the sediment load allocation is intended to reduce sediment load to a level that is felt to approach the natural load. At, or slightly above, this load it is expected that fine sediment deposited within spawning habitat would be decreased and channel stability would be enhanced. As described in the TMDL it is felt that the load capacity that would result in proportions of intragravel fine sediment that would facilitate full support of aquatic life related beneficial uses likely lies between the natural background sediment load and that currently experienced by the Pahsimeroi River. One of the basic premises of stable river channels is that they are able to transport their sediment load and to have access to their flood plain. Streams are self formed and self maintained to manage sediment transport, however when sediment load increases by removal of riparian vegetation or alteration of flow regime, the river adjusts it's channel to accommodate sediment load and to regain access to the flood plain. Implementation of Best Management Practices (BMPs), and monitoring of sediment and beneficial use support after projects are implemented should show the level of sediment that the Pahsimeroi River can transport under current climatic and flow conditions and still fully support beneficial aquatic life uses.

Comments from William Stewart, Environmental Protection Specialist, EPA Region 10 Idaho Operations Office

General Comments

1) *Better maps would be useful to gain an understanding of the watershed. The stream names on the map on page 21 are difficult to read on this copy.*

   We will attempt to increase the font size of the maps within the TMDL. Additionally, an overview map that shows the distribution of erosion inventory reaches will be added.

2) *The discussion on temperature on pages 31 – 32 seems to indicate that not all of the segments are in compliance with state or federal standards. The data should be displayed in a manner which allows comparison with the standards to determine whether or not there is a basis for future 303(d) listing of some or all of these segments for temperature exceedances.*

   The narrative on page 31 and 32 within the TMDL is based on the summary of data provided by the BLM. Prior to developing the Subbasin Assessment for a particular watershed, a letter requesting water quality data is sent to land management agencies.

Often the data that is submitted is summarized in relation to agency standards and Publications only, and often the raw data is not submitted for analysis in development of the Subbasin Assessment or TMDL. This was the case with the Pahsimeroi River Subbasin Assessment and TMDL, and the narrative reflects the ambiguous nature of the data summary provided.

The discrepancies between the data summary and the state's water quality standards are identified on page 32 in paragraph 3. The summary of BLM temperature data does not provide adequate data to develop a temperature loading analysis for the streams identified in the summary. Perhaps future data collection will result in more comprehensive quantitative data with which to develop a loading analysis.

The Department of Environmental Quality was able to obtain some quantitative temperature data from the Idaho Department of Fish and Game's Pahsimeroi River Hatchery. The IDFG temperature data is adequate to show that the Pahsimeroi River exceeds state temperature standards for salmonid spawning, and a load reduction based on applicable water quality standards can be formulated to show the percent reduction in water temperature needed to bring the Pahsimeroi River into compliance with state water quality standards. The cause of temperature loading is strongly related to flow alteration due to irrigation diversions and irrigation return flow as well as removal of riparian vegetation from overgrazing along certain reaches.

In addition to requesting public comment on the draft assessment of water quality conditions in the Pahsimeroi River comment was solicited on proposed changes to the subbasin's 303(d) listing on streams primarily affected by flow alteration. At such time that flow is restored to these streams further analysis of temperature loading can be undertaken.

3) *On page 33, it appears that E. coli levels in the Pahsimeroi exceed the state water quality standards, but there is not enough data to determine impairment of beneficial uses. Please explain what the IDEQ plans are to confirm E. coli levels and establish whether a pathogen TMDL is needed for the river.*

During the 2000 field season DEQ contracted E-coli and Fecal Coliform sampling in the Pahsimeroi watershed. The final report was obtained in October 2000, and as you state in your comment, elevated levels were shown. Follow-up sampling during July of 2000 at two sites on the Pahsimeroi River were below water quality standards: 200cfu/100 ml on 7/27/01 at Dowton Lane and 150cfu/100 ml on 7/27/01 at the USGS gauging station just above the Salmon River confluence. DEQ will continue monitoring e-coli in conjunction with wadable and large river Beneficial Use Reconnaissance Program monitoring at an additional site on the lower river to evaluate the potential need for a TMDL for pathogens in the future. Other sites sampled during the 2000 field season were dry.

4) *On page 37, the second paragraph, substitute the word "irrigation" for the word "irritation."*

This typographic error will be corrected.

5) *Please give a clear description of the method used to determine the reductions in sediment for each reach and how this correlated with bank stability for the reach. It is difficult to understand how a 75% total reduction on the river relates to a condition of 80% bank stability.*

The relationship between the sediment load, in tons of sediment produced by a stream reach, and the proportion of stable streambanks is described under Load Allocations on Page 38, and the method for estimating the sediment load from the inventory of stream bank erosion is explained in Appendix F, which is referenced on Page 38 under Load Allocations.

The prescribed load reduction, or the load allocation, is the difference between the sediment load estimate based on current observed streambank conditions and the sediment load that is estimated based on the future desired condition of 80% streambank stability. An erosion estimate based on current conditions may show that a stream has 60% streambank stability that equates to an erosion rate of 10 tons per mile per year. After appropriate riparian management is established, and given time for riparian vegetation to recover, streambank stability may improve to 80%, which may equate to an erosion rate of 25 tons per mile per year. This would be a reduction in streambank erosion of 75% correlated with an improvement in streambank stability of 33%. Within the streambank erosion inventory sediment load estimate the variables that affect the estimate include average height of the streambank and the lateral recession rate (the horizontal loss of streambank to the stream through crumbling, sloughing, rotational failure, clumping etc.), as well as the portion of the stream banks that are not stable (erosive). A reduction in any of the variables would result in a reduction in the erosion associated with that particular streambank. The most responsive and detectable change under riparian management is improved streambank stability, though a reduction in streambank height and lateral recession would likely accompany an improvement in streambank stability (an increase in stability or a reduction in instability). When current or observed streambank erosion that is related to streambank stability that is less than 80% is compared with streambank of 80% stability the difference in sediment loading becomes the load reduction. The erosion rate under the prescribed condition of 80% or more streambank stability becomes the load allocation, or the permissible rate of erosion that would fully support beneficial uses. The rate of erosion may change at a rate different than the change in streambank stability. We will expand upon the description of the methods used to determine the reductions in sediment based on streambank condition under Load Allocations on Page 38.

6) *In table 14, sediment load allocations/reductions by erosion inventory reach., on page 39, the "proposed total erosion rate" appears to show an increase from the total erosion rate for reach numbers 1,7, and 14. We don't understand why 3 of the reaches are allowed to degrade slightly.*

The erosion estimate for the reaches you cite (1,7, and 14) are based on the current observed condition which equates to streambank stability of 80%, 90%, and 80% respectively. The current observed conditions for these reaches also exhibit an estimated recession rate of 0.04, 0.05, and 0.04 respectively. The recession rate for reaches 1 and 14 are lower than the rate set for the overall desired future condition of 0.05 which shows that there could be a net increase of erosion and the reach would still be within the sediment allocation set for that reach under the desired future condition.

Reach 7 has an estimated current streambank stability of 90%. With the streambank stability target set at 80%, the sediment reduction shows as an increase. This is not to say that the stream segment will be allowed to "degrade." It does show that conditions of some reaches are actually better than the level set within the TMDL. It should not be assumed that where conditions are better than those prescribed in the TMDL that they will be allowed to degrade. It would be better to view the TMDL as the total maximum daily load as opposed to the total minimum daily load.

7) *On Table 1 and Table 14, the column labeled "Proposed Total Erosion Rate (t/y)" should be called "Load Allocations."*

   We will make the recommended change to the column title.

8) *The waste load allocation needs to be clearly defined with a direct statement or table in the executive summary and in the discussion on page 37-38.*

   We will add a direct statement and Waste Load Allocation table pertaining to the point source discharge solids from the Idaho Fish and Game Pahsimeroi Hatchery.

GLOSSARY

7Q2 – A term used in the state Water Quality Standard to express the lowest 7-day average flow with an average frequency of recurrence of every two years.

"A" channel - A Rosgen channel type characterized by a fairly straight (sinuosity < 1.2), steep (high gradient 2-10%), highly confined (<1.4), single channel, with a low (<12) width to depth ratio.

Adaptive Management – An explicit and analytical process for adjusting management and research decisions to better achieve management objectives; this process should quantitative wherever feasible. Adaptive management recognizes that knowledge about natural resource systems is uncertain. Therefore, some management actions are best conducted as experiments in a continuing attempt to reduce the risk arising from that uncertainty. The aim of such experimentation is to find a way to achieve the objectives as quickly as possible while avoiding inadvertent mistakes that could lead to unsatisfactory results. The concept of adaptive management is readily understood because it represents the common sense of "learning by doing."

Agriculture Water Supply - A beneficial use, designated by the Division of Water Quality, which indicates that water quality is at such a level that it can be used for irrigation or livestock watering.

Aesthetics and Human Health - A beneficial use, designated by the Division of Water Quality, which indicates that water quality is good enough to not pose a significant health risk or be aesthetically unpleasant.

Allotment - An area of land designated and managed for the grazing of livestock.

Allotment Management Plan - A plan designed by the permitting agency and the user which prescribes the grazing management for the allotment, including rotation system and resource objectives.

Anadromous - An aquatic life history strategy where freshwater habitat is used for spawning and juvenile rearing and the ocean (saltwater) is used for maturation to adult.

Aspect - The direction a surface is facing, generally related to a magnetic bearing. A south aspect would face south.

Attainable Beneficial Use or Attainable Use – A beneficial use, that with appropriate point and nonpoint source controls, a water body could support in the future.

Background – The biological, chemical, or physical conditions of waters measured at a point immediately upstream (up gradient) of the influence of an individual point or nonpoint source discharge, or existing prior to the point or nonpoint discharge if no valid up gradient site is available.

Base Flow - The water flow as measured during the period of lowest standard flow; in this area, it is usually mid-summer.

"B" channel - A Rosgen channel type characterized by a moderately straight (sinuosity 1.2-1.4), steep (high gradient < 2-9%), moderately confined (1.4-2.2), single channel, with moderate (14-26) width to depth ratio.

Beneficial Use - A term used by the Idaho Department of Environmental Quality to identify uses which water quality supports in a given stream or lake.

Best Management Practice (BMP) - A state of Idaho standard that defines a component practice or combination of component practices determined to be the most effective, practical means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.

Biological Evaluation/Assessment - A process document that evaluates the effect of a regulated action on the biologic species under investigation and quantifies the extent of that effect. If it is determined that an action "may affect" the given species, consultation with the designated oversight agency (either National Marine Fisheries Service or US Fish and Wildlife Service) is required.

BLM - Bureau of Land Management, United States Department of the Interior.

C - Celsius; a temperature scale where freezing occurs at 0 degrees and boiling at 100 degrees.

Candidate Species - A species under investigation for listing under the Endangered Species Act, but for which limited information is known about its current status or biological vulnerability, or for which regulatory rules have been created but not issued.

"C" channel - A Rosgen channel type characterized by a winding (sinuosity > 1.4), flat (low gradient < 1-3.9%), unconfined (> 2.2), single channel, with a moderate to high (> 12) width to depth ratio .

***Carex/Juncus* Community** - A vegetative community composed predominately of sedges and rushes.

cfs - cubic feet per second; used for characterizing the volume of moving water in a stream.

Channelization - The action of altering the natural stream channel and hydrology of the system to redirect water flow or prevent soil loss.

Channel Type - A classification system which seeks to identify the hydrologic characteristics of a stream, such as sinuosity, gradient, meander potential and bank characteristics.

Cobble Embeddedness - The degree to which cobbles are surrounded or covered by fine sediment (sand or silt); usually expressed as a percentage.

Cold Water Biota - A beneficial use, designated by the Idaho Division of Water Quality, which indicates that water quality is high enough to support macroinvertebrates and fish.

Cumulative Effects - All of the combined actions and resultant effects which must be considered to effectively evaluate the effect of an additional, new action (i.e., a review to see if this is "the straw that will break the camel's back").

Deferred Rotation - A grazing system in which pastures are used at different times each year.

Degradation - The alteration of a given biological community in a negative manner which reduces the viability or diversity of the community and results in a change in ecological processes.

DEQ – State of Idaho Department of Environmental Quality.

Discretionary Action - An action that a land management agency has the ability to regulate.

Dispersed Recreation - Any recreational activity that doesn't occur at a designated recreational site or area.

Diversion - A physical structure that redirects water flow from a stream or spring into a ditch used for irrigation purposes.

Diversity - A variety of plants, animals or community types.

Ecological Condition - A reflection of the dynamic equilibrium of an overall watershed; the long term health of the complete system and not individual parts of it.

Ephemeral - A water source that only flows at certain, irregular times of the year, such as at spring runoff or during thunderstorms.

F - Fahrenheit; a temperature scale where freezing occurs at 32 degrees and boiling at 212 degrees.

Fault - A fracture or a zone of fractures along which there has been displacement of the sides relative to one another parallel to the fracture.

Fecal Coliform Bacteria – A type of bacteria common to the digestive tract of warm blooded animals that is identified as an indicator of the presence of a range of pathogenic bacteria that can cause illness to humans or livestock if ingested.

Fines – A particle of sediment below a designated diameter (such as 6.35 mm) that is known to effect salmonid egg or fry survival through emergence.

Fish Screen - A screen on a diversion designed to allow water to flow through it while preventing passage by fish and directing them back into the stream.

Flood Irrigation - A method of irrigation using water diverted from a stream or spring through a ditch that allows the water to flow across a wide area, using gravity or topography to spread the water.

Forb - Any herbaceous plant, other than a grass, especially one growing in a field or meadow.

Forest Land - Forested lands of ten or more acres capable of being ten percent stocked by forest tree species, and not currently set aside for non-timber use.

FS – United States Forest Service, Department of Agriculture

Full Support – A category of water quality status. A water body whose status is "Full Support" is in compliance with those levels of water quality criteria listed in Idaho's *Water Quality Standards and Wastewater Treatment Requirements*, or with reference conditions approved by the Idaho Department of Environmental Quality Director in consultation with the appropriate Basin Advisory Group.

Functional at Risk Condition - Riparian-wetland areas that are in a functional condition but an existing soil, water or vegetation attribute makes them susceptible to degradation.

Geometric Mean – The nth root of the product of n data: $((X_1)(X_2)(X_3))^{1/3}$ Used to establish the central tendency when averages of rates or index numbers are required.

Gradient - A measure of steepness of ascent or descent. In this document it is usually used in reference to streams and the topographical rate of descent.

Habitat Inventory - A stream habitat inventory evaluates and attempts to characterize the stream channel. A riparian habitat inventory evaluates the vegetative characteristics of the riparian corridor.

Herbaceous (vegetation) - A vegetative group including grasses and forbs, but excluding woody vegetation such as willows or sagebrush.

Habitat Index (HI) - A tool used to evaluate whether beneficial uses of aquatic life are being supported; aquatic habitat criteria are scored and compared against a standard based on the ecoregion being evaluated.

Hydrologic Divide - Topographical feature that bounds a watershed or watershed by forcing all water to flow one direction (e.g., Continental Divide).

Hydrology - The scientific study of the properties, distribution and effects of water on and below the earth surface; the effect of flowing water on the land or stream channel.

Instantaneous – A characteristic of a substance measured at any moment (instant) in time.

Interdisciplinary Team - A team comprised of people with various educational or professional backgrounds and individual abilities.

Intermittent - A water source which only flows on the surface at irregular intervals along the stream channel. It flows subsurface along the remainder of the stream channel.
Issue - A matter of wide concern.

Land Disposal - A process of transferring land from public ownership to private ownership.

Land Exchange - A transfer of land of nearly equal value between public and public ownership.

Lateral Recession Rate - The rate at which a stream bank erodes away from its original position in relation to the stream.

Loading: Acute – The relatively short duration of the presence or addition of a pollutant, such as sediment or bacteria, to surface water above specified water quality criteria.

Loading: Chronic – The longer term duration of the presence of a pollutant, such as sediment or bacteria, to surface water above specified water quality criteria.

Macroinvertebrate Biotic Index (MBI) - A tool used to evaluate water quality based on quantitative measurements of biological attributes of the communities of aquatic insects present at a sample site. Scores are adjusted based on the ecoregion being evaluated.

Margin of Safety – The additional load reduction applied to a load allocation to increase the likelihood that beneficial uses will be restored in a reasonable period of time.

Monotype - A community that contains only one species of vegetation, lacking the normal diversity found in similar locations.

Moraine - A pile of debris, including rocks and dirt, which is pushed ahead of, or along the sides of a glacier.

Natural Condition – A condition without human-based disruptions.

Needs Verification - A category of water quality status. A water body whose status is "Needs Verification" has not been assessed due to a need for additional information that will allow the distinction between "Full Support" and "Not Full Support."

Non-Functioning Condition - Riparian-wetland areas that are clearly not providing adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows and thus are not reducing erosion, improving water quality, etc. The absence of certain physical attributes such as a floodplain where one should be is an indicator of nonfunctioning conditions.

Non-point Source Pollution – A pollution source that is ill-defined or comes from a broad area, such as sedimentation.

Not Full Support – A category of water quality status. A water body whose status is "Not Full Support" is not in compliance with those levels of water quality criteria listed in Idaho's *Water Quality Standards and Wastewater Treatment Requirements*, or with reference conditions approved by the Idaho Department of Environmental Quality Director in consultation with the appropriate Basin Advisory Group.

Noxious Weed - A weed arbitrarily defined by law as being especially undesirable, troublesome and difficult to control.

OHV - Off-highway vehicle; any vehicle capable of traveling off the highway.

Outmigration - The action of fish leaving their birthplace, rearing or spawning area and moving a significant distance out of a given system into another for the needs of a different life stage.

PACFISH - A BLM and FS directed, comprehensive and coordinated strategy for restoring and protecting the habitat of anadromous fish affected by dam construction and operation, water diversions, hatchery operations, fish harvest and the widespread degradation of the habitats of these species.

Parcel - Any piece of land.

Patented Land - Land that has been transferred to private ownership, and that is still retained by the original owner.

Perennial - A water source that flows throughout the year, each and every year.

Physiographic Province - A region of which all parts are similar in geologic structure and climate, and which has consequently had a unified geomorphic history.

Pollution – Any alteration in the character or quality of the environment that renders it unfit or less suited for beneficial uses.

Primary Contact Recreation - A beneficial use, designated by the Division of Water Quality, that indicates that water quality is good enough for any activity in which full or partial, unprotected bodily contact occurs with water (e.g. swimming or wading).

Proper Functioning Condition - Riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris are present to dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality. This vegetation also filters sediment; captures bedload; and aids floodplain development; improves flood-water retention and ground-water recharge; develops root masses that stabilize stream banks against cutting action; develops diverse ponding and channel characteristics to provide the habitat and the water depth, duration and temperature necessary for fish production, waterfowl breeding and other uses; and supports great biodiversity. The functioning condition of riparian wetland areas is a result of interaction among geology, soil, water and vegetation.

Range Condition - A classification system (Excellent, Good, Fair or Poor), which provides an indication of the ecological health of the area and the degree of management necessary to maintain or improve the current condition. These classifications are generally indicated by differences in species composition, or deviation from the perceived potential of the site. Differences between condition classes are somewhat arbitrary because they form a continuum across a spectrum with ill-defined borders.

Reconnaissance – An exploratory or preliminary survey of an area.

Redd - The spawning nest of a fish dug in the stream bottom, which covers the eggs until emergence.

Reference Condition – A condition that fully supports applicable beneficial uses, with little effect from human activity and represents the highest level of support attainable.

Regression Analysis – Regression Analysis is the analysis of the relationship of two variables that may allow prediction of one variable from another variable. The dependent variable is assumed to be determined by (is a function of) the magnitude of the second (independent) variable.

Resident Fish – Non-anadromous fish that are generally native or naturalized exotic species. Resident fish may migrate within or between subbasins or watersheds at various life history stages to utilize various habitat aspects within their preferred range.

Resource Objective - An objective to be reached or maintained, which defines the desired condition of the resources.

Riparian - A vegetative community associated with surface or subsurface waters and watercourses within active watersheds. This community is rich in diversity of plants, as well as wildlife and aquatic organisms. The habitat includes not only lake and river ecosystems, but also wetland communities.

Riparian Habitat Conservation Agreement (RHCA) - A PACFISH term designating portions of watersheds where riparian-dependant resources receive primary emphasis, and management activities are subject to specific standards and guidelines. These areas include traditional riparian corridors, wetlands, intermittent headwater streams, and other areas where proper ecological processes are crucial to the maintenance of the stream's water, sediment, woody debris, and nutrient delivery systems.

Riparian Management Objective (RMO) - Objectives that are designed to measure the functionality of the riparian area and its affected stream channel. PACFISH has a set of RMO's that must be met for streams with anadromous fish unless local biologists have data that can define ones better suited to local conditions.

Salable Timber - Timber in an area designated for commercial timber harvest, accessible for harvest, and which contains trees favorable for sale.

Salmonid Spawning - A beneficial use, designated by the Idaho Division of Water Quality, which indicates that water quality is good enough for salmonid fish to use for spawning with a high chance of egg survival.

Screened Diversion - A diversion which has a fish screen on it.

Secondary Contact Recreation - A beneficial use, designated by the Idaho Division of Water Quality, which indicates that water quality supports any activity in which partial or incidental, protected bodily contact occurs with water (e.g., fishing).

Sediment-Sorbed – Molecules adhering to the surface of a solid sediment.

Shrub - Multi-stemmed woody vegetation not large enough to be considered a tree, such as a rose, willow, current, etc.

Sinuosity - The ratio of stream channel length to valley length.

Subbasin - A collection of watersheds that forms a much larger area, which yet drains into another, larger system.

Substrate - The stream bottom, composed of silt, sand, gravel, cobble, boulder or bedrock. The type of substrate and its looseness affects the ability of fish to spawn and the survivability of the eggs.

Suspended Sediment - Fine sediment suspended within the water column of moving or standing water.

Synoptic Sampling - Sampling at an upstream site, and timing sampling at a downstream site, such that the sample is collected at the time the same water sampled upstream is passing the sampling location downstream. The purpose is to take out any diurnal variance in water conditions.

Terminal Moraine - A pile of dirt and rocks pushed in front of a moving glacier that was left behind when the glacier receded.

Thermal Sanctuary - A refuge area that has water temperatures lower or higher than the surrounding waters, to the degree that it reduces the metabolic stress to the fish (e.g., a tributary spring or upwelling groundwater source).

Thrust Fault - A fault with a dip of 45 degrees or less over much of its extent, on which the hanging block appears to have moved upward relative to the footwall. Horizontal compression rather than vertical displacement is its characteristic feature.

Topography - The physical features of a place or region.

Transverse Fault - A fault that strikes obliquely or perpendicular to the general structural trend of the region.

Tributary - A river or stream that flows into a larger river or stream.

Unauthorized Use - An action or use of federal lands that has not been authorized by the regulatory agency or is outside the allowable season of use.

Unscreened Diversion - A diversion that does not have a fish screen on it.

Viability - Capability to grow or develop under normal conditions.

Warranted but Precluded - A phrase used to indicate that a species under consideration for listing as threatened or endangered probably should be listed but other species are in more immediate danger and time or monies don't allow for equal consideration at this time.

WEPP – Water Erosion Prediction Project: the WEPP model is a process-based, distributed parameter, continuous simulation, erosion prediction model for use on personal computers. The software is produced by the U.S. Department of Agriculture National Soil Erosion Research Laboratory at Purdue University and is available for free download at: http://topsoil.nserl.purdue.edu/weppmain/wepp.html.

Water Body – A homogeneous classification that can be assigned to rivers, lakes, estuaries, coastlines, streams or other water features.

Water Quality – A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use.

Water Quality Target – An interim goal of water quality or habitat condition that provides the potential for beneficial use status of "Full Support." Percent subsurface or instream surface fine sediment, stream bank stability, percent overhead cover, riparian buffer width and average daily stream temperature are examples of possible targets.

Watershed - A side stream and all the land that it drains, which is a tributary to a much larger stream or river.

Wolman Pebble Count - A monitoring tool used to determine the amount of surface fines (material < 6.35 mm) as an index of sedimentation and beneficial use impairment. The samples are conducted at the same sites macroinvertebrates are collected. The sampler walks across the stream, from bankfull width to bankfull width, selecting pebbles at equidistant intervals. The intermediate axis is measured and recorded for each sample. A minimum of 50 samples from each cross-section must be obtained.

Woodland - Forested land used to provide forest resources such as firewood and Christmas trees, and is not used in the determination of the annual allowable cut.

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